creative computing

$3.95

BUYER'S 1984 GUIDE

TO PERSONAL COMPUTERS & PERIPHERALS

HOW TO BUY:

A PRINTER

14 EVALUATED / 40 COMPARED

A COMPUTER

IN-DEPTH EVALUATIONS OF:

TRS-80 MODEL 4
TRS-80 MODEL 100
TI PROFESSIONAL
DEC RAINBOW 100
MATTEL AQUARIUS
COLUMBIA MPC 1600-1
COMPUTER DEVICES DOT
FRANKLIN ACE 1200
APPLE IIe
TRS-80 MC-10
TI CC-40
COMMODORE 64
VIDEO TECHNOLOGY VZ-200
SPECTRAVIDEO SV-328
NEC PC 8201
MICROTER ACE 4000
EPSON HX-20
OLIVETTI M20
NEC PC-6000
COMPAQ
PIED PIPER
HEATH H100
HP-75
IBM PC-XT
LISA

43
0 14024 14296

COMPARISON CHART OF 65 POPULAR COMPUTERS

WHILE OTHER COMPUTER COMPANIES ARE BUSY SETTING NEW PRICES,

SPECTRAVIDEO IS BUSY SETTING NEW STANDARDS.

© 1983 SPECTRA VIDEO, INC.

MSX™ and LOGO™: Two Spectravideo is in Personal

While price wars and confusion reign all around us, Spectravideo goes about its business, setting standards by which all other personal computers will soon be judged. MSX and LOGO are the two latest examples of how Spectravideo is rocking–and reshaping –the personal computer industry.

MSX AND LOGO.

It is now history that, on June 15 1983, Spectravideo, Inc. joined with most of Japan's largest electronics firms to launch MSX: The most far-reaching personal computer standard in history. MSX is the name given to a specific hardware/software configuration that makes product interchangeability possible. While Spectravideo is proud to participate in MSX, we are even prouder of this fact: It was our own SV-318 computer that was used as a prototype for the MSX design! There are two important aspects to this.

First, all future MSX hardware–i.e. computers, peripherals, appliances–will be based on several key design elements of the SV-318. What does this mean to you, the consumer? A great deal, because when you buy an SV-318, you will not only be able to use all of Spectravideo's own software and hardware–you'll also be able to take advantage of all the remarkable new equipment that will be coming from other MSX participants.

In addition, the software aspect of MSX was largely inspired by the software built into the SV-318. From the outset, Spectravideo offered built-in Microsoft BASIC as its resident interpreter. Now, Microsoft

FOR UNDER $300.

FOR KEYBOARD ONLY

32K ROM EXPANDABLE TO 96K 32K RAM EXPANDABLE TO 256K

more reasons why leading the way computers.

also makes a LOGO program compatible with the SV-318. It was Spectravideo's Microsoft BASIC/LOGO that helped to make MSX possible.

Another standard that Spectravideo can take credit for is the built-in Joystick/Cursor Control. Built right into the SV console, this control is always at fingertips and is much easier and faster to use than external joysticks or conventional editing controls. Certain engineering elements that helped to make this built-in control possible have also been incorporated into MSX.

OTHER STANDARDS OF EXCELLENCE.

While these are the computer standardizations that Spectravideo helped to initiate, they by no means represent the whole SV-318 story. This remarkable computer has also established many standards of excellence that other personal computers now aspire to:

- ***Built-In Super Extended Microsoft BASIC***–*Makes the SV-318 the first truly programmable affordable computer!*
- ***Extraordinary Memory***–*32K ROM expandable to 96K, and 32K RAM expandable (via bank switching)to an amazing 256K.*
- ***Unparalleled Expandability***–*A full supporting system of 14 peripherals, including our new Colecovision™ Game Adapter, 7-Slot Expander Unit, Floppy Disk Drive, Data Cassette, Interface Cartridges, etc.*
- ***More Available Software***–*Built-in CP/M compatibility gives you immediate access to over 3,000 existing software programs. Plus, you can utilize Spectravideo's own fine software library.*
- ***Advanced Graphics Capabilities***–*The SV-318 offers 16 colors in high resolution, and more importantly, 32 programmable sprites that allow tremendous control of movable screen objects.*
- ***Many other fine features***–*Such as Z80A Microprocessor with fast (3.6) internal clock, top-loading cartridge slot, 10 user-programmable special function keys, 3 sound channels (8 octaves per channel!), low profile and attractive styling.*

SPECTRAVIDEO™

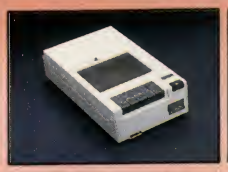
Computer systems you'll grow into, not out of.

SPECTRA VIDEO, INC. 39 W. 37TH STREET, NEW YORK, N.Y. 10018

CIRCLE 131 ON READER SERVICE CARD

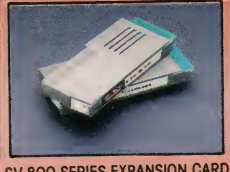
Spectravideo's personal computers are supported by a full line of high-quality peripheral products

MSX
compatible software standard


SV-903 DATA CASSETTE

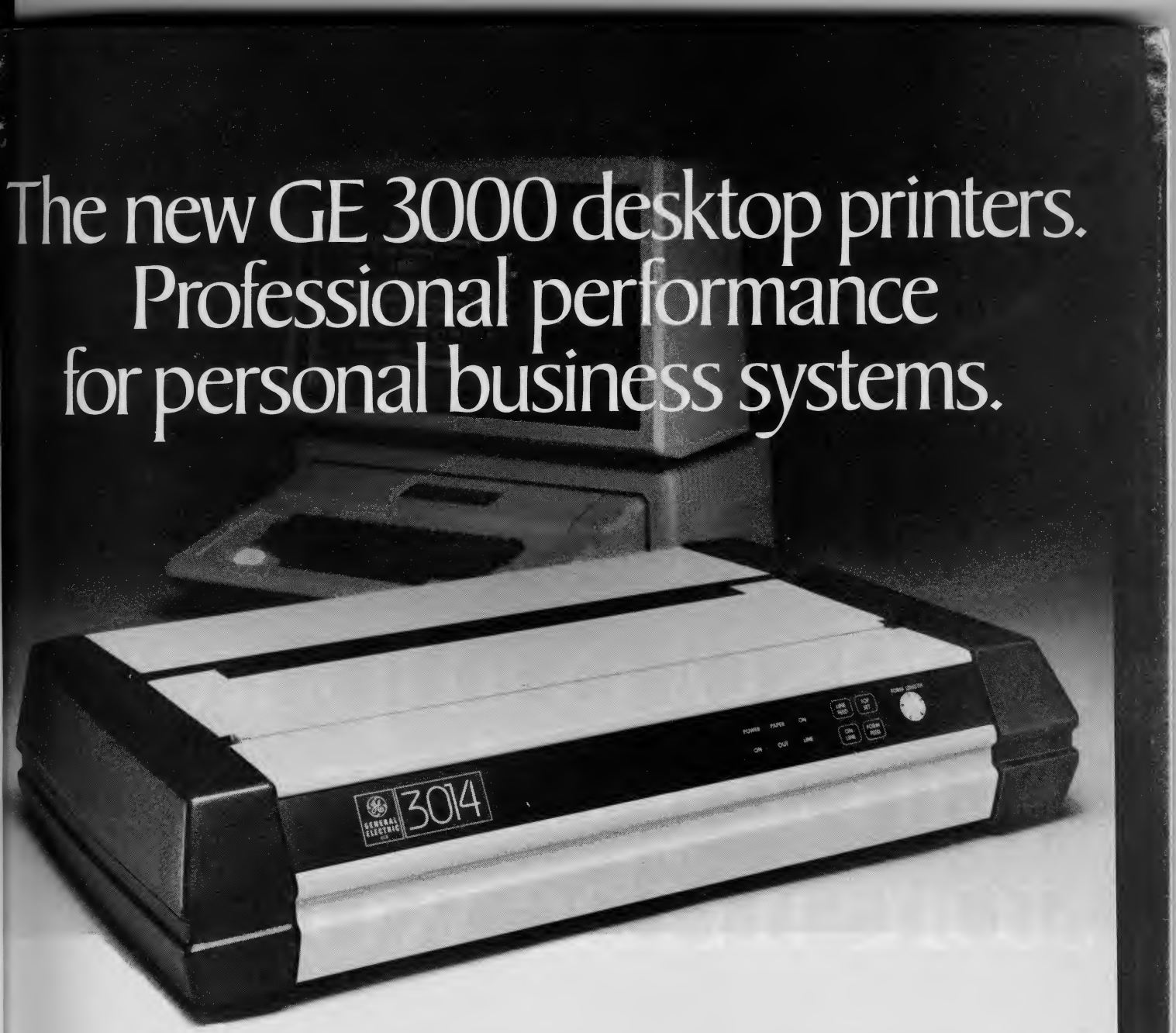
SV-601 SUPER EXPANDER

SV-902 FLOPPY DISK DRIVE


SV-800 SERIES EXPANSION CARDS

CP/M is a trademark of Digital Research, Inc.
MSX, Microsoft LOGO, and Microsoft Extended BASIC is a trademark of Microsoft Corporation Colecovision is a registered trademark of Coleco Industries.

The new GE 3000 desktop printers. Professional performance for personal business systems.



Now you can take care of business with General Electric's new professional level 3000 printers designed and priced primarily for desktop business computers.

Price/performance matched for personal business system applications, the new models include the multi-mode GE 3014 and GE 3024 with EDP, Memo and NLQ. And they're built to the same quality standards as other members of the GE 3000 printer series.

Both models offer switch selectable hardware and software interface compatibility with major desktop microcomputers, plus speed and throughput capacities to match user application needs. Speeds range from 160 cps to 200 cps in EDP, 80 cps to 100 cps Memo and 40 cps to 50 cps NLQ.

Flexible dot resolution and positioning allow creation of a wide variety of type styles. Graphics, 136 column width, parallel or serial interfaces, single document inserter, automatic sheet feeders, extended line buffers, and downline loadable character sets are some of the features and options available for the printers that provide you personal business system printing solutions.

Of course, they're all easy to use, lightweight, and functionally styled. Most important, GE printers are reliable and built for continuous duty cycle printing.

So when you're ready to get down to business, pick up the phone and call GE.

General Electric. We introduced the first fully electronic printer with LSI circuitry in 1969. And our complete line today makes us the industry leader you should look to first.

First In Electronic Printing.

For the solution to your printing needs, call

TOLL FREE 1-800-GE PRINT

General Electric Company, Data Communication Products Department B332, Waynesboro, VA 22980. In Virginia, call 1-703-949-1170.

GENERAL ELECTRIC

CIRCLE 112 ON READER SERVICE CARD

We've helped more kinds of people buy more kinds of computers than any other store in the world.

Make friends with the future.℠

Over 500 Stores Worldwide.

© 1983 ComputerLand

CIRCLE 109 ON READER SERVICE CARD

ntents...contents...conte

7 **How To Buy A Microcomputer**.....*Anderson*
Making the decisions of the 80's

10 **Timex Sinclair 1000**.....*Grosjean*
An affordable way to find out

12 **Video Technology VZ 200**.....*Ahl*
Many unexpected features at surprisingly low cost

19 **Mattel Aquarius**.....*Ahl & Linzmayer*
Barbie, bits and bytes

28 **TRS-80 MC-10**.....*Linzmayer*
Too little, too late for too much?

31 **TI 99/4A**.....*Arrants*
Low cost color and sound

34 **Jupiter Ace 4000**.....*Helck*
A Forth computer

36 **News From Commodore**.....*Anderson*

42 **Commodore 64**.....*Jeffries*
More than a 40-column Vic

46 **What's Coming From Atari**.....*Anderson*
New machines from an industry giant

48 **Atari 400 and 800**.....*Anderson*
One of these may still be a best buy

51 **TRS-80 Color Computer**.....*Linzmayer*
A colorful, low cost offering from Tandy

55 **SpectraVideo SV-318 and SV-328**.....*Ahl*
Computers to grow into

63 **Epson HX-20**.....*Ahl*
Everything but the kitchen sink . . . and it's portable

72 **TRS-80 Model 100**.....*Anderson*
The first purely practical portable

80 **Face Off**.....*Ahl*
The Model 100 vs. the NEC PC-8201

84 **Hewlett-Packard HP-75**.....*Hart*
A powerful pocket portable

88 **TI CC-40**.....*Devlin*
Notebook size with a powerful Basic

94 **NEC PC-6001A**.....*Goodman*
An experimenter's delight

98 **TRS-80 Model 4**.....*Gray*
More business oriented than the Model III

104 **Pied Piper Communicator**.....*Devlin*
Whither thou goest thy computer will go

108 **Apple IIe**.....*Arrants*
A significant step up for Apple lovers

112 **H/Z 100**.....*Anderson*
Heath won't let you fail

114 **Olivetti L1 M20**.....*Ahl*
A lightning fast business system

124 **TI Professional**.....*Berk*
An alternative to IBM?

126 **Compaq**.....*Devlin*
An IBM-compatible portable

128 **Computer Devices DOT**.....*Ahl*
A compact business system

134 **Franklin Ace 1200**.....*Arrants*
An Apple-compatible at a bargain price

136 **IBM PC-XT**.....*Sandler*
A big brother for Baby Blue

140 **Columbia MPC 1600-1**.....*Sandler*
Call it a "work alike"

142 **In Love With Lisa**.....*Merken*
Apple makes a hit

147 **DEC Rainbow 100**.....*Ahl*
The mighty mini maker enters the fray

156 **Computer Comparison Chart**.....*Devlin & Koncur*
66 popular computers at a glance

172 **Buying A Printer**.....*Ahl*
Where to begin and what to look for

179 **Print About Printers**.....*Anderson*
In-depth evaluations of 14 printers

192 **Printer Comparison Chart**.....*Devlin & Koncur*
45 printers from which to choose

Creative Computing Buyer's Guide to Personal Computers and Peripherals

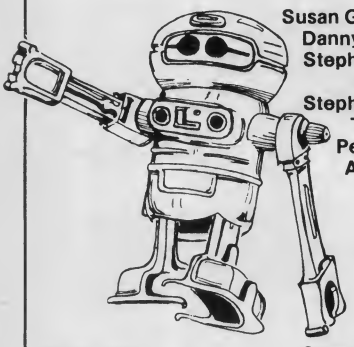
Creative Computing Buyer's Guide to Personal Computers and Peripherals is published annually by Ahl Computing, Inc., 39 E. Hanover Avenue, Morris Plains, NJ 07950, (201) 540-0445. David H. Ahl, President; Elizabeth B. Staples, Vice President; also publishers of *SYNC* and *Video and Arcade Games*.

Ahl Computing, Inc. is a subsidiary of Ziff-Davis Publishing Company, One Park Avenue, New York, NY 10016. Richard Friese, President; Selwyn Taubman, Treasurer; Bertram A. Abrams, Secretary.

Copyright ©1983 by Ahl Computing, Inc. All Rights Reserved.

staff

Founder/Editor-in-Chief	**David H. Ahl**
Editor	**Elizabeth B. Staples**
Managing Editor	**Peter Fee**
Associate Editors	**John Anderson** **Joseph Devlin** **Stephen Arrants**
Editor-at-Large	**Ken Uston**
Contributing Editors	**Dale Archibald** **Will Fastie** **Susan Glinert-Cole** **Danny Goodman** **Stephen B. Gray** **Glenn Hart** **Stephen Kimmel** **Ted Nelson** **Peter Payack** **Alvin Toffler**



Staff Writer	**Owen Linzmayer**
Copy Editor	**Sherrie Van Tyle**
Editorial Assistants	**Andrew Brill** **Laura Gibbons**
Art Director	**Patrick Calkins**
Assistant Art Director	**Chris DeMilia**
Artists	**Diana Negri Rudio** **Eugene Bicknell** **Paul Krasner**
Typesetting	**Karen K.Brown**
Advertising Director	**Claude Sheer**
Creative Computing Press	**Laura Conboy**
Operations Manager	**Patricia Kennelly**
Comptroller	**Jennifer H. Shaler**
Accounting	**Joanne Sapio** **Alfred Nardi**
Retail Marketing	**Susan DeMark**
Fulfillment	**Frances Miskovich** **Rosemary Bender** **Linda Blank** **Pat Champion** **Elsie Graff** **Linda McCatharn** **Carol Vita** **Jim Zecchin** **Diane Moran** **Barbara Carnegie** **Lisa Dickisson** **David Stankus** **Maura Russell** **Donna Stiefel** **Dawn Weber** **Cheryl Schauble** **Valerie Gaddis**
Shipping & Receiving	**Ronald Antonaccio** **Mark Archambault** **Scott McLeod** **Mike Gribbon** **Strawvey Montgomery**

advertising sales

Advertising Director
Claude Sheer
Creative Computing
Ziff-Davis Publishing Company
One Park Avenue
New York, NY 10016
(212) 725-3577

Advertising Coordinator
Ruth Darling
Creative Computing
Ziff-Davis Publishing Company
One Park Ave.
New York, NY 10016
(212) 725-3446

Northern California, Northwest
Jeff Miller
Ziff-Davis Publishing Company
3030 Bridgeway Blvd.
Sausalito, CA 94965
(415) 331-7133

Southern California, Southwest
Tom Whiteway
Ziff-Davis Publishing Company
3460 Wilshire Blvd.
Los Angeles, CA 90010
(213) 387-2100

New England
CEL Associates, Inc.
27 Adams Street
Braintree, MA 02184
(617) 848-9306

Midwest
Jeff Edman
The Pattis Group
4761 W. Touhy Ave.
Lincolnwood, IL 60646
(312) 679-1100

Mid-Atlantic
Larry Levine
Ziff-Davis Publishing Company
One Park Ave.
New York, NY 10016
(212) 725-7668

Southeast
Browning Publications
P.O. Box 81306
Atlanta, GA 30366
(404) 455-3430

Canada
The Pattis Group
1623 Younge St.
Toronto, Ontario M4T 241
(416) 482-6288

Ziff Davis Consumer Computers & Electronics Magazine Division
President: Larry Sporn
Vice President Marketing: J. Scott Briggs
Vice President Circulation: Carole Mandel
Vice President/ General Manager: Eileen G. Markowitz
Creative Director: Peter J. Blank

permissions

Material in this publication may not be reproduced in any form without permission. Requests for permission should be directed to Bette Amado, Ziff-Davis Publishing Company, One Park Avenue, New York, New York 10016.

NEW

Let Colonel Byte take your child on a trip through Cybernia

They'll learn all about computers along the way!

Growing up in the computer world will be easier if your child understands computers. And there's no better place to start than with the computer that's in your home—and with the help of this delightful book.

Computer Parade reads like a story book. Yet it actually teaches the basics of computer operation.

Computer Parade traces the adventures of Katie and her brother after they fall into the family computer. Once inside the computer, they find themselves in the imaginary land of Cybernia where they meet Colonel Byte. Colonel Byte takes them to a computer parade, where they learn how computer music is made. All along their fanciful journey, the threesome encounters friendly and ferocious dragons, computer bits, eeks and aaks. And of course they're always on the lookout for program bugs.

Any youngster age 4-10 will delight in *Computer Parade*. It's easy to read and richly illustrated in full color.

Help your child grow up computer literate by ordering your copies now.

MAIL TODAY TO:
CREATIVE COMPUTING PRESS
Dept. HC6C 39 East Hanover Avenue,
Morris Plains, NJ 07950

Please send me_____ copies of *Computer Parade* for $9.95 each, plus $2.00 shipping & handling per book.

Total Amount $_____ 9P

☐ Payment Enclosed. (CA, NJ and NY State residents please add applicable sales tax.)

☐ Charge my:
☐ American Express ☐ MasterCard ☐ Visa

Card #_____ Exp._____

Signature_____

NAME_____
(please print)

ADDRESS_____

CITY_____

STATE_____ ZIP_____

*Outside U.S., add $3 for shipping and handling.

☐ Check here to receive a FREE catalog of computing books, magazines and guides.

Also available in your local bookstore or computer store.

For Faster Service,
PHONE TOLL FREE: 800-631-8112
(In NJ only: 201-540-0445)

You can wait for industry standards to mandate improved performance. Or you can have it now on Maxell. The Gold Standard.

The refinements of The Gold Standard, from oxide particles to lubricant to jacket, are uniquely Maxell. And therefore, so are the benefits.

Our unique, uniform crystals assure dense oxide packing. So you begin with an original signal of extraordinary fidelity. A signal we safeguard in ways that leave industry standards in our wake.

An advanced binder bonds oxides to the base material preventing time and money-wasting dropouts. Calendering then smooths the surface for a read/write signal that stays clear and accurate. And lubricants reduce friction between head and disk for a longer media and head life. To house it, we then constructed a new jacket heat-resistant to 140° F to withstand drive heat without warp or wear. And created the floppy disk that leads the industry in error-free performance and durability.

All industry standards exist to assure reliable performance. The Gold Standard expresses a higher aim: perfection.

maxell®

IT'S WORTH IT.

Computer Products Division, Maxell Corporation of America, 60 Oxford Drive, Moonachie, N.J. 07074 201-440-8020

CIRCLE 102 ON READER SERVICE CARD

How to Buy a Microcomputer

John J. Anderson

So you think you want a computer, eh? Well the first thing to make very sure of is that you really do want a computer. Maybe you only *think* you think you want a computer. Maybe you want one just because everyone else seems to be getting them. That's a great way to become disappointed and disenchanted. Not everyone who gets a computer is happy with the decision, you know. Though they may be loathe to admit it.

We at *Creative Computing* hear variations on the questions "What computer is best?" and "What computer should I buy?" more frequently than any other microcomputer question. These are not the kinds of questions we can really answer. It simply *depends*: on what you expect, what you can spend, what you consider to be value.

Personal computers have been withstanding a bit of negative press reaction lately. This is easy to understand, as the belated backlash of the extended romance the media have had with the machines. Now the honeymoon is over. The media have discovered that computers aren't for everybody. They won't take the place of sliced bread. They won't walk the dog. They won't do people's thinking for them. They won't do windows.

Fad or Fixture?

Some zealous "journalists" have made the invariably trite comparison of the faddishness of the home computer with the faddishness of the hula hoop. How quickly the press turns.

So why should anyone want a home computer? It's just a fad, right?

Reasons we have heard are: to balance the checkbook, play games, learn about computers, manage home finances, do word processing, prepare tax returns, communicate via modem, monitor lights and appliances, help with the children's education, learn programming, play with as a hobby, manage a small business.

Admit it. If your computer ends up in the closet, none of these things will be possible. So if you are sure you want one, it is of utmost importance to choose the right machine.

Still want to buy a computer? Well good luck. Buying a computer nowadays is in some ways a much tougher job than it was some years back.

Even a year ago, your choice in machines was very dependent upon your price range, as opposed to your desires.

Things are very different now. In almost every price range a plethora of machines is available, each with its own set of advantages and disadvantages. The machine you choose will depend greatly on the features you consider most important for your own needs. And, on the fortunate side for you, in the current microcomputer price wars the consumer is the real victor.

What Are Your Needs?

But how to determine those needs? For a long time the stock answer to that question has been that software needs should determine hardware needs. In other words, go out into the cold hard world of software and see what programs you most want to run. Then purchase the machine that is capable of running the largest number of those programs.

This remains sound advice, with a caveat. New machines, despite the scope of their potential, rarely have much software around when first introduced. These machines for a time sell more or less on faith.

As an example, consider the Commodore 64 machine. When it first appeared, there was very little software for it. It has taken a while for quality software to turn up for the machine—that process, in fact, is still taking place. And yet to dismiss the 64 for lack of software would be very shortsighted. The machine will be with us for quite some time to come.

The gamble, in truth, is whether the promising machine in which you are interested will turn out to be a winner or a loser. If it really is a good value, if it sells, if third party developers see a market forming, lots of quality software will become available for it. If not, you'll be left with a computer that fades away fast. Some of us old timers remember the Sorcerer, the Videobrain, and the

ACEWriter II
Sophisticated word processing that's easy to learn

ACECalc
VisiCalc®-compatible spreadsheet analysis program with 80 columns of variable width

ACE Display card
Opens video display to a full 80 columns by 24 lines

ACE 80 CPU card
Allows you to run CP/M and Apple® II programs

ACE Dual Interface card
Allows you to connect to local and remote printers, terminals, computers and other accessories

Apple II compatible

64K of RAM

Ulc Upper & lowercase

Typewriter-style keyboard

12-key numeric pad

VisiCalc keys

50-watt power supply

Built-in fan

1982

Apple II compatible

64K of RAM

Ulc Upper & lowercase

Typewriter-style keyboard

12-key numeric pad

VisiCalc keys

50-watt power supply

Built-in fan

1983

Good. Better.

And you thought Franklin was good before.

Well, look at Franklin now. You'll find our ACE product line has grown . . . and grown. To include sophisticated word processing. Sensational spreadsheet analysis. And an array of peripheral boards. So you can expand the capabilities of your ACE 1000 as your business needs increase. Our product line's not the only thing that's grown. Franklin now has more than 1,000 authorized dealers throughout the country. So, if you thought we were good before, come see us now.

Apple is a registered trademark of Apple Computer Inc.
VisiCalc is a registered trademark of Visi Corp.

FRANKLIN
COMPUTER CORPORATION
Better than ever.

2128 Route 38; Cherry Hill, NJ 08002 Telephone: 609-482-5900; Telex: 837-385

CIRCLE 145 ON READER SERVICE CARD

Imagination Machine. These machines were all promising at the time they were introduced. They probably still can do a lot—that is, if you are a programmer.

Therefore, in the long haul, the machine with an established software library is the safer bet. It is quite like the old dilemma concerning chickens and eggs and which came first. In the world of microcomputers, the chicken has to come first; you can't design software without hardware. Then the eggs start to happen.

Translating my earlier advice into the metaphor, you should examine the kinds of eggs available, then purchase a chicken capable of laying the ones you want. (I hope my thoughts aren't becoming too scrambled here.)

Step-By-Step

So how can you decide which microcomputer is for you?

- Determine your price range. Come up with a maximum price for the entire starter system, including three or four software packages. Then stick to that price. Remember that you will want more peripherals, like printers, modems, etc., a little further down the line.
- Determine what machines are available within that price range. Don't just look at the base sticker price for a given computer, but determine what it will cost to put together a running starter system. This usually means at least a mass storage device, like cassette recorder or disk drives, and in some cases a monitor, if connection to an existing TV is undesirable or impossible.
- Look at the kinds of software available for each machine. Compare them, category by category, feature by feature. Note which machines have better graphics, simpler means of operation, more desirable packages. This is the way to learn what any machine can really do. It is also the way to get an education concerning features vs. prices.
- Decide which overall set of software is best for you. This is the toughest part of the decision-making process. A machine that is strong in business and serious applications may fall short in the games-playing department, and vice versa. In judging which body of software is better, you will not only be choosing between computers, but weighing your own expectations. This is the key to choosing a machine with which you will be happy.
- Buy the machine that runs that software. In this way you will avoid disappointment.

Bear in mind that a computer is not really a computer until it is attached to a mass storage device. This is a means of creating and accessing records, and for full effect, means a disk drive. At the least it means an audio cassette drive. If you bought a computer that has a ROM cartridge slot and buy all your software on cartridge, storing and loading software will be very convenient. But without a storage device, you will miss out on a big part of what computers are all about.

My own advice is to plan the budget for an early disk drive. Cassettes will break your heart, and on occasion your spirit. They are terrific for audio, but not the best digital medium: they are slow, finicky, prone to damage through stretching or catching, and do not offer the potential of random access. Once you experience the convenience of a floppy disk, you will never want to load another cassette.

Remember also that *software*, as opposed to hardware, will end up being the major investment. Unless you are a crack programmer and intend to write all your own software, you will be buying software often, so plan accordingly.

And keep your sunny side up! □

The MAGIC you've been waiting for is now available for only $2,295

Magic has it all!

- **Compatibility**
  Magic comes with CP/M 2.2 giving access to a large variety of proven software.
- **Capability**
  Magic provides a high resolution monitor and two DSDD disk drives for substantial data storage.
- **Useability**
  Magic comes with Perfect-Writer®, Perfect Speller®, Perfect-Calc®, Perfect-Filer® and CBASIC™ ready for immediate use.
- **Portability**
  Magic's keyboard with numeric pad stores easily within the system housing for transporting to different locations.
- **Flexibility**
  Magic comes with a RS232C and a parallel adapter — ready to be connected to a modem and/or printer of your choice.
- **Reliability**
  Magic is a "quality" system using "state-of-the-art" components and is backed by a 120-day unconditional warranty.

You can believe it's

Magic computer

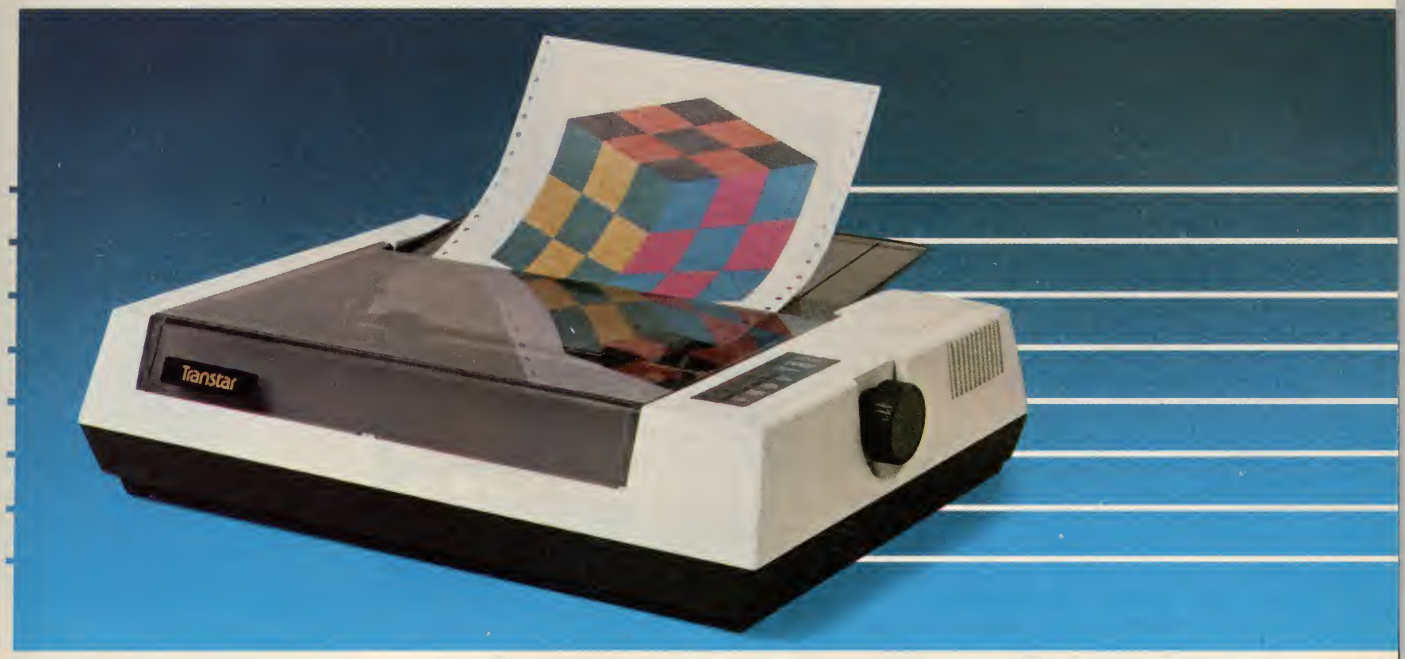
For additional information, contact your local computer dealer or

MAGIC Computer Company, Inc.
2 Executive Drive • Fort Lee, NJ 07024
(201) 944-6700 • 800-221-1565

CIRCLE 118 ON READER SERVICE CARD

Innovative technology brings you quality color printing

for only $599



The technology of the all-new Transtar 315 color printer revolutionizes color impact printing! Unlike old-fashioned printers needing multiple passes with pins to print color, the Transtar 315 employs an innovative 4-hammer print head to allow 7 colors and more than 30 shades to be printed in a **single pass!**

A unique 4-color diagonal ribbon maximizes the efficiency of the 315's color imaging and enhances its simple reliability. Built by Seikosha, the most experienced manufacturing company of the famous Seiko group, the Transtar 315 is **available now** and has been designed to be compatible with the IBM, Apple II/IIe and Franklin personal computers. An optional PICS card also allows Apple and Franklin users to simply depress the 315's "copy" button to print any high- or low-resolution screen without exiting a program!

Transtar is bringing the technology of tomorrow to you today. **Your future in color printing is only $599 away.**

Transtar

P.O. Box C-96975, Bellevue, Washington 98009

CIRCLE 137 ON READER SERVICE CARD

Timex Sinclair 1000

An Affordable Way To Find Out

Paul Grosjean

If you have been wondering whether you can afford to take a leap into the computer age, the Timex Sinclair 1000 will let you take that leap without gambling a bundle.

CPU, ROM, and RAM

At the heart of the TS1000 are the Sinclair 8K ROM memory, which contains the Sinclair dialect of Basic, and the Z80A CPU, which can also be programmed in Z80 machine language.

Three features of the ROM are especially valuable. First, commands and functions are entered as single keystrokes. Each key has up to six uses: command, function, lowercase (the unshifted key), uppercase (shifted), and graphics (two on each key). Second, the SLOW mode of operation allows you to create moving graphics from Basic. Third, the syntax checker will not allow the entry of an incorrect program line.

The 2K RAM on board leaves approximately 1200 bytes for programming after allowing for system demands and display file requirements. This is about as much as most users will want to punch in at the beginning. Plug-in modules will expand the RAM to 16K, 32K, or 64K.

The Display

The display has 32 characters across and 24 down. Each character space is divided into four pixels (picture elements) for graphics. While these screen pixels are somewhat coarse, each of the 64 dots in the character block can be programmed to provide hi-res graphics on the printer.

Although the display is output to a standard TV set on channel 2 or 3, the quality of the display depends largely on the TV set and its sensitivity to interference.

The Keyboard

The membrane keyboard has the advantages of keeping the computer small; being impervious to dust, hair, gum, etc.; and allowing the use of keyboard overlays for some programs. However, it is a source of frustration for some users because of the small size and the lack of tactile feedback. Keeping an eye on the display while typing is not only wise but necessary. Touch typing, at least in the beginning, is rather difficult, especially since the keys have multiple functions. However, the single keystroke entry for commands and functions compensates somewhat for the disadvantages of the membrane keyboard.

Expansion

An expansion port with a 46-line edge connector allows plugging in additional RAM and the Timex 2040 printer. Other devices, such as modems, may also be used with appropriate interfaces and software. Heavy users should consider adding one of the full-size auxiliary keyboards which range from do-it-yourself second-hand keyboards to units that simply plug into the expansion port. A minor hardware modification allows you to use a high quality monitor for the display.

Saving and Loading

Although most standard cassette recorders can be used for saving and loading, many users experience their greatest frustration here. In most cases the problem seems to be with the recorder or the tape, so you may have to try a variety of recorders before you find one that works reliably.

The Manual

The manual provides a valuable introduction to Sinclair Basic and the use of the machine, but it is not a complete course on programming in Basic by any means. So, if you are a total beginner in Basic, you will probably want to supplement the manual with a good book on

programming in Sinclair Basic and then perhaps move on to a book on machine language for the TS1000.

Support

Support for the TS1000 is extensive. The Buyer's Guide issues of *SYNC* Magazine (May/June, July/August, September/October 1983) included over 1200 items from over 400 suppliers: books, games, a wide variety of software packages, and hardware for computer expansion and use. TS1000 users can also draw upon the software already developed for other computers using the Z80 CPU, but modification is required.

creative computing
HARDWARE PROFILE

Name: Timex Sinclair 1000

Type: Personal home computer

CPU: Z80A

RAM (min/max): 2K; 16K; 32K; 64K

ROM: 8K Sinclair ROM

Type of keyboard: Membrane

Text resolution: 32 x 24

Graphics resolution: 64 x 48

Number of colors: 0

Sound capability: No

Ports: 46 line I/O

Dimensions (HxWxD): 7" x 6 1/2" x 1 3/4"

Documentation: Fair

Summary: A fantastic opportunity to enter the computer age at an affordable price.

Price: $49.95

Manufacturer:
Timex Computer Corp.
Waterbury, CT 06725

The Uses of the Computer

Though widely dismissed as a toy by those who have not taken the effort to become familiar with the computer, the TS1000 can be used for anything that Basic and Z80 machine language can do (within the memory limits of the system). Obviously, its cost makes it an ideal tool for learning to program in Basic and Z80 machine language. For the same reason it can be used as a dedicated computer. Its size and portability make possible the "businessman's briefcase." The CPU puts handshaking with other Z80 machines in reach.

Conclusion

All in all, the TS1000 provides a fantastic opportunity to enter the computer age at a cost that is affordable by virtually anyone. □

DATA ASSETTE

BRING YOUR COMPUTER TO LIFE

WORD PROCESSING AND REAL PRINTING
TIMEX/SINCLAIR TS1000, TS1500, OR ZX81

PROFESSIONAL WORD PROCESSING AND PRINTING FOR LESS THAN THE COST OF A TYPEWRITER

$79.95
X-WORD ZX-101
WORD-PROCESSING

- 16K ROM Software
- Full RS232 Interface
- Word Star like commands
- On-line edit to 14K with 16K RAM pack
- Total cursor control, move, delete, etc.
- Upper or lower case ASC II character
- Automatic paragraph reformating

$250.00
PRINTER
GORILLA/BANANA

- 10" Carriage
- 5 X 7 Dot Matrix
- 50 Characters per sec
- 5 or 10 Characters per in
- Tractor Feed

Now for a limited time Data-Assette offers three choices to obtain these powerful solutions:

OPTION #1 = $299

Ready to run package
- Printer
- X-Word System
- Paper Supply
- All cables

Real Cost $370.00
Your Savings $71

OPTION #2 = $399

Option #1 plus
- TS1000 (2K) new
- Overlay Keyboard
- 16K of Ram Pack

Real Cost $480.00
Your Savings $81

OPTION #3 = $499

Option #1 plus
- TS1000 (2K) new
- Fullsize Keyboard
- 32K of RAM pack

Real Cost $595.00
Your Savings $96

ORDER TODAY BY PHONE FROM OUR SPECIAL 800 NUMBER OR MAIL IN YOUR CHOICE.
WE ACCEPT VISA OR MASTERCARD.

DATA-ASSETTE

All orders are subject to a $4.95 handling/shipping charge

Mail Order Department
56 South 3rd Street
Oxford, PA 19363

(800) 523-2909
(215) 932-4807 in PA

*If you already own a printer then X-word is available for $79.95. If you only need the printer then its cost is $250.00. Send $2.50 for our full catalogue and receive $2.50 credit on first purchase.

CIRCLE 144 ON READER SERVICE CARD

Shelf Conscious?

Now you can organize your copies of your Favorite Magazines

Now your magazines can be a handsome addition to your decor, well organized, and easy to find, thanks to these durable library-quality cases or binders. They're made of luxury-look leatherette over high-quality binders board. And both styles are custom-designed for most magazines you save, with sizes, colors, and imprints selected by the publishers. FREE transfer foil included for marking dates and volumes.

Magazine binders
hold a year's issues on individual snap-in rods, combining them into one volume. $7.95 each; 3 for $22.50; 6 for $42.95. Mixed titles OK for quantity prices.

Open-back cases
store your issues for individual reference. $6.95 each; 3 for $19.75; 6 for $37.50. Mixed titles OK for quantity prices.

Charge Orders Only. TOLL FREE
800-526-0790. In NJ only 201-540-0445

Jesse Jones Box Corp., Dept. ZD, Philadelphia, PA 19141
Please send: ☐ Cases ☐ Binders QUANT.
Title:
Title:
☐ ENCLOSED IS $_____.* Add $1.00 per order for postage & handling. Outside USA add $2.50 per unit ordered. Send U.S. funds only.
☐ CHARGE (Min. $10): ☐ VISA ☐ American Express ☐ MasterCard
Card#_____ Exp. Date_____
Signature_____
Print Name_____
City/State/Zip_____
*PA residents add 6% sales tax.

Video Technology VZ200 Personal Computer

The VZ200 with 16K RAM memory pack.

David H. Ahl

The Video Technology VZ200 is a compact microcomputer with a great deal of capability and many unexpected features at a very attractive price.

The VZ200 is based on the 6502 microprocessor, the same one found in the Apple, Commodore, and Atari computers. The 12K ROM memory includes the monitor and an excellent implementation of Microsoft Basic.

The RAM memory included with the basic unit is a sparse 4K. Two plug-in expansion modules are available, one with 16K and the other with 64K. These modules plug into a slot on the back of the computer and extend out about 5.5″.

The computer itself measures 11.4″ x 6.3″ x 2″. Two-thirds of the top surface is occupied by a keyboard with 45 keys in four rows. The keys are "Chiclet" style rubber and have a very short throw. Touch typing is possible in only a rather limited way. Although key spacing is the same as on a regular typewriter, the rubberized keys have a different "feel." Much more disastrous for touch typing is the fact that there is no space bar; instead a space key is found at the right end of the bottom row next to the period. This also means that there is only one shift key (at the left end of the bottom row). Several other keys do not have the expected characters; for example the question mark is on the L key.

On the bright side, each key on the VZ200 keyboard provides several functions in addition to typing a single letter, number, or symbol. All the Basic commands, keywords, and functions can be produced by holding down the control key (or control and RETURN keys) while the key is pressed. This is most welcome. Most other computers which produce Basic keywords with a single keystroke can produce only as many words as there are keys, i.e., one keyword per key. Each key on the VZ200, in contrast, produces two Basic keywords and one or two regular characters. Sixteen graphics characters can also be produced directly from the keyboard.

All the Basic commands, keywords, and functions can be produced with a single keystroke.

When a key is pressed, it makes a short "beep" indicating one keystroke. If it is held down, it automatically repeats with a beep indicating each key entry.

The top of the computer also has an on/off light. An on/off switch is recessed on the right side of the case.

The Basic Language

As mentioned earlier, the VZ200 has an excellent implementation of Microsoft Basic. This includes 9 commands, 27 statements, 11 arithmetic functions, 9 string functions, 7 graphics and sound functions, and the expected arithmetic, relational and Boolean operators.

Among the statements that we do not always see in a computer in this price range are INP (reads the contents of input ports), OUT (sends values to output ports), USR (calls an assembly language subroutine), and COPY (copies the content of the screen onto a printer). Naturally, for the COPY command to work, you must use a printer which recognizes the VZ200 screen codes, in particular, a Seikosha GP-100 or GP-100A.

We were also pleased to find both PRINT USING and PRINT @ implemented. The latter command is useful to print things at different screen locations without having to use blank print lines or tabs. However, a tab function is available for programs that require it.

On-Screen Editing

Full on-screen editing makes it a pleasure to program on the VZ200. To edit a line of code, it is not necessary to invoke an EDIT command or remember a set of editing commands as one must do on the TRS-80 Color Computer and many others. Instead, on the VZ200, the line to be edited is listed, by itself, with the whole program or with a group of lines. By using the four directional keys on the bottom right of the keyboard, the cursor is moved to the character to be changed. You type the change, move the cursor to the end of the line (remember, a key repeats by holding it down), and type RETURN. Voila! The change is made. On-screen editing can also use the DELETE, INSERT, and RUBOUT keys.

COMPUTER PALACE

Over 1000 Items For Your Atari!

ATARI®

We Know ATARI Computers... Call Us For The Latest Info: (503)683-5361

Pole Position

$44.90

The reviews are coming in on this one, and it sounds like another Winner From Atari!!! Super Scrolling Screen... Fast Speedway Action! 16K Cartridge

- Store 500-2000 files per disk.
- Fast machine language sorts.
- Works on single or double density.
- Automatic delete of duplicates.
- Special coding feature.
- Official state abbreviations are built in.
- Re-label fields for unlimited uses.
- Merge files. ● Create sub-files.
- Search files on any field.

FREE Catalog

With any order, or send $1 (refundable with purchase). Send us your name & address for FREE QUARTERLY FLYERS with SPECIALS!

Over 1000 items for your Atari...

- Mosaic ● Percom
- Broderbund ● APX
- Roklan ● Datasoft
- Synapse ● A.I.
- On-Line ● Atari
- Hayes ● Epson
- Visicalc ● More!

Use Your Credit Cards!

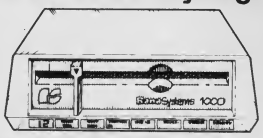
We honor VISA, American Express, & MasterCard.

24 & 48 Hour Shipping Is Available... CALL!

RANA 1000 Disk Drive

NEW

- Double Density!
- Hi-Tech Styling!



$349.00 Plus Freight

DONKEY KONG™

16K Cartridge

$44.90

This one has been worth waiting for! It is one of the BEST Conversions of an Arcade Game to date!!! **From ATARI**

Welcome To Computer Palace...

When you are in Eugene, Oregon, please visit our well-stocked store and talk with our experienced, helpful Atari Experts. We have the largest selection of Atari Software & Hardware in the Northwest!

We specialize in Atari... So we know what works best!!!

$54.00

The Monkey Wrench II

A cartridge for the right-hand Slot of your Atari 800!

This is a BASIC & Machine-language **Programmers Aid** for the 800. It plugs into the right slot, and works with Atari BASIC to add 16 new direct-mode commands(Incl. Auto line numbering, Delete lines; Renumber BASIC; Hex-Dec conv.; Find string; Move lines; Exchange string; Disk directory from BASIC; Mem test; More.) Also includes a monitor with 15 commands to interact with the 6502. This has been proven to be a very helpful tool when writing your own programs!

ALL-TIME FAVORITES

Star Raiders(C)	38.20
Eastern Front (D,T)	27.90
Pacman (C)	39.50
Temple of Apshi (D,T)	35.10
Zork I, II, or III (D)	each 35.10
Centipede (C)	39.50
Missle Command (C)	29.70
Shamus (D,T)	31.50
Ghost Hunter (D)	34.95
Ghost Hunter (T)	29.95

TOP-TEN GAMES

Zaxxon (D,T)	35.10
Donkey Kong (C)	44.90
Choplifter (C)	39.50
Astro Chase (D,T)	26.90
Miner 2049er (C)	44.90
Football (D,T)	29.60
Pharaoh's Curse (D,T)	31.50
Dig Dug (C)	39.50
Way Out (D)	35.10
Ultima II (D)	52.50

SUPER SPECIALS!

LIMITED QUANTITIES—WHILE SUPPLIES LAST!

	Retail	Special	
Krazy Shootout (C)	29.95	**17.95**	
32K Ram Board	99.00	**68.50**	
Bit-3, 80 col. board	350.00	**259.00**	
A Steal! Microsoft Basic (D)	100.00	**59.00**	
Percom Drive (40-S2)	999.00	**699.00**	
Pecom Drive (44-S1)	895.00	**599.00**	
Gorf (D)	39.95	**19.95**	
Canyon Climber (D,T)	29.95	**15.95**	
Pacific Coast Hwy. (D)	29.95	**15.95**	
Crypt of the Undead (D)	29.95	**18.95**	
Baja Buggies (D,T)	32.95	**17.95**	
Jaw Breaker (D,T)	29.95	**19.95**	
Threshold (D)	39.95	**27.95**	
Protector II (D,T)	34.95	**19.95**	
Kstar Patrol (C)	39.95	**19.95**	
Krazy Kritters (C)	39.95	**19.95**	

	Retail	Special	
Krazy Antics (C)	39.95	**19.95**	
Frogger (D,T)	34.95	**23.95**	
Airstrike (D,T)	39.95	**23.95**	
Baseball (C)	49.95	**29.95**	
Moonbase I/O (D,T)	29.95	**19.95**	
Smartware (D) Datasoft	125.00	**59.00**	
Picnic Paranoia (D,T)	34.95	**19.95**	
Dr. Goodcodes Cavern (D)	29.95	**9.95**	Wow!
Match Racer (D,T)	29.95	**9.95**	Look!
Intruder Alert (D,T)	16.95	**7.95**	Super!
Claim Jumper (T)	34.95	**19.95**	
Nautilus (D,T)	34.95	**19.95**	
Chicken (D,T)	34.95	**19.95**	
Slime (D,T)	34.95	**19.95**	
Deluxe Invaders (C)	39.95	**29.90**	
Pogoman (D,T)	29.95	**14.95**	

HARDWARE

Astra Disk Drive	499.00
Micromainframe Disk Drive	499.00
Percom Disk Drive (DD)	479.00
Atari 1010 Recorder	86.00
Atari 1025 Printer	499.00
Panasonic Monitor (Grn Scrn. w/sound)	199.00
Dust Covers (400/800/410/810)	each 8.95
Prostick II Joystick	27.50

SOFTWARE

Ft. Apocalypse (D,T)	31.50
Shadow World (D,T)	31.50
Microsoft Basic II (C)	79.10
Diskey Utility (D)	44.90
Pinhead (D,T)	26.90
Jumpman (D)	35.10
Crush, Crumble & Chomp (D,T)	26.90
Odessa Chess (D)	59.50
Speedway Blast (C)	36.90
Sammy the Seaserpent (T)	15.90
Pre-School I.Q. Builder (T)	15.90

COMPUTER PALACE

OPEN Monday - Saturday, 9 to 6

2160 W. 11th Avenue Eugene, Oregon 97402

MasterCard VISA AMERICAN EXPRESS

USE YOUR CREDIT CARD & CALL

Toll Free 1-800-452-8013

(Orders Only, Please)

For Information Call (503)683-5361

Shipping Note: UPS & Parcel Post-$2.00—UPS Air-$3.90 Shipping on hardware & paper supplis extra—Call for $.

24 & 48 hour shipping available... Call (503)683-5361

We specialize in *ATARI Compatible Products*
So we know what works best!!!
Call for the latest info... (503)683-5361

CIRCLE 128 ON READER SERVICE CARD

Four I/O connectors and two plug-in slots are on the back.

We experienced two small problems with on-screen editing. First, the cursor directional keys are activated by pressing the control key on the left and one of the directional keys on the right. It was all too easy to hit the shift key instead of the control key, but this is probably something that one gets used to after using the computer for a few days. The other problem was that after a while the editing buffer seems to overflow and further editing is not accepted. Admittedly, we were trying to push the computer over the brink and it is unlikely that this will be a problem in normal use.

Video Display

The VZ200 produces two forms of video output: a composite video signal for a monitor and an RF signal on Channels 2 or 3 for a standard NTSC TV set. We found the monitor signal rock steady, whereas the RF signal required very precise fine tuning of our TV set. Even on the monitor, we found that to produce the correct colors, the tint control had to be turned to one extreme.

Output from the VZ200 is in one of two modes: low-resolution text and graphics or medium-resolution graphics only. In the mixed mode, the VZ200 produces 16 lines of 32 characters each. Alphabetic characters are available in uppercase only. Also available are 16 graphics characters which divide each screen location into four boxes. The 16 characters are, of course, all combinations of these boxes being filled in.

Each low-resolution graphics character can be turned on in any of eight colors; the off portion shows as black which can be considered a ninth color. Alphanumeric characters are displayed either as yellow on green or yellow on buff (actually a red-orange). Text can also be displayed in inverse—either individual characters or the entire screen. Only one background color can be used on the screen at a time, green or buff. The background color does not affect the color of graphics characters.

Low-resolution graphics characters can be typed into programs directly from the keyboard or called with CHR$ (128) to CHR$ (255) from a program.

In medium-resolution graphics mode, the screen is divided into 128 x 64 pixels (actually, small boxes). Each pixel is turned on by the command SET (x,y). The command RESET (x,y) turns off a pixel, and POINT (x,y) examines whether a pixel is on or off. The first two commands are equivalent to PSET and PRESET in some other computers. Figure 1 is a listing of a simple program using these commands to make a bouncing ball leave a kaleidoscopic trail around the screen.

```
10 CLS:PRINT "KALEIDOSCOPE  BY
DAVE AHL":PRINT
20 X=1: Y=1: XU=126: YU=62: Z=1
30 INPUT "ENTER 1,2, OR 3";I
40 I=.5*I: J=1
50 MODE (1)                          Set hi-res graphics mode
60 X=X+I                             Compute new x and y
70 Y=Y+J                             position
80 COLOR (RND(8))
90 IF X>=XU OR X<=Z THEN I=-I:       Tests to see if edge of
SOUND 30,1                           screen has been reached.
100 IF Y>=YU OR Y<=Z THEN J=-J:      If so, reverse direction
SOUND 27,1                           of bounce.
110 SET (X,Y)                        Draw new spot
120 GOTO 60
```

Figure 1. Program produces a kaleidoscopic pattern of eight colors on the screen. The input parameter changes the incremental amount added to each successive horizontal or X position. Each time the leading edge of the pattern hits a border of the screen, a beep tone is sounded.

In this graphics mode, only three colors plus the background color (four in total) are available simultaneously.

In addition to SET and RESET, screen locations can also be changed and examined by means of POKE and PEEK statements. Of course, these statements allow changing and examining any RAM memory location, not just the screen locations.

Musical Sounds

The SOUND command is simple and straightforward. The single sound channel on the VZ200 can produce 31 frequencies (2-½ octaves) and nine note durations (from a dotted half note to a thirty-second note). The command takes the structure SOUND (p,d) where p is the pitch (1 to 31 and 0 for a rest) and d is the duration.

Problems

Speaking of pushing the computer to the brink, we found several things from which there was no way to recover short of turning the computer off. Even BREAK (the equivalent of RESET on some other machines) failed to return control of the computer to the user. The most common irrecoverable condition was LLIST. This would normally list a program on the line printer. However, if no line printer is attached, the computer hangs. This is particularly bad because the rubberized keys tend to bounce a bit and it is very easy to type LLIST instead of just plain LIST. If you have a long program in the computer and have to turn it off because it hangs up as we did four or five times, you are forgiven if you become a bit surly toward the machine.

The surest cure is to use Control/4 to list a program. After a while, we learned to do this.

Other things that would hang the machine are all in the same family, in particular, trying to use a peripheral device that is not attached. In some cases, the VZ200 gave an error message, but in some others it went into never-never land.

We also had a problem loading the programs from the cassette tape included with the computer. We tried three recorders, including a high-quality digital unit, but the only thing the VZ200 would say was "FOUND T: Program Name" and that was it. We saw the programs load at CES, so we assume we got a faulty demo tape with our system.

Peripherals

The VZ200 has an interface to a stan-

Hayes

Your computer's telephone.

A personal computer without communications, is like a car without gasoline. It can't go anywhere.

It needs a special telephone (called a modem), to get you communicating with other computers. Across the city. Or the entire country.

Whether you're swapping programs with friends or club members. Working at home and sending reports to the office. Or taking advantage of a wealth of information from any of the networks or information utilities. Telecomputing greatly expands the world of your personal computer.

And Hayes provides the communications link. Smartmodem 300, and the faster Smartmodem 1200, work with any computer with an RS-232C I/O port. Plugging your computer directly into the phone system, they allow you to communicate over ordinary phone lines with computers and terminals anywhere in America.

But any modem will send and receive data.

A Hayes Smartmodem also dials, answers and disconnects calls. Automatically. And it does this without going through the telephone receiver, a design feature that makes it far superior to acoustic coupler modems.

Choose your speed, choose your price. Hayes Smartmodems are available at two different speeds and price levels. The lower-priced Smartmodem 300 is ideal for local data swaps and communicates at 300 bps.

For longer distances and larger volumes, Smartmodem 1200 operates at 1200 bps or up to 300 bps, with a built-in selector that automatically detects transmission speeds.

Both modems work with rotary dials, Touch-Tone* and key-set systems. We've even included an audio speaker and indicator lights so you can monitor the communications process. Smartmodem 1200 has an additional indicator light that detects high-speed transmission. And, unlike many modems, both Smartmodems operate at full or half duplex, for compatibility with most time-sharing systems.

At Hayes, all of these "extras" are standard. We've built our reputation on superior quality. Excellent documentation. A limited two-year warranty. And a wide range of software support. Including our own hot-selling Smartcom II™ communications software for the IBM** PC, making Smartmodem 300 and 1200 even easier for you to use.

See your computer dealer today for a demonstration. Then break out of isolation. Get a Hayes telephone for your computer.

Hayes®

Hayes Microcomputer Products, Inc., 5923 Peachtree Industrial Blvd., Norcross, Georgia 30092. 404/449-8791.

Smartcom II is a trademark of Hayes Microcomputer Proucts, Inc.
*TM American Telephone & Telegraph
**IBM is a registered trademark of International Business Machines, Corp.
©1983 Hayes Microcomputer Products, Inc.
Sold only in the U.S.A.

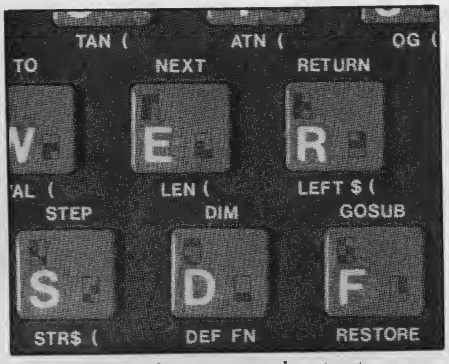
CIRCLE 114 ON READER SERVICE CARD

dard cassette recorder which operates at a Baud rate of 600 bps. This is somewhat slower than other new computers which have rates up to 2400 bps; nevertheless it is twice a fast as machines of just a few years ago. A program that fills the entire 4K of memory with program code takes about 54 seconds to load; a 16K program takes four minutes to load. Bear in mind, however, that most 16K programs do not use 16K of code; much of the memory space is taken by dimensioned arrays and the like.

The manufacturer specifications note that a peripheral expansion bus is built-in, however, we are not quite sure what this means. It appears that expansion modules, which, presumably, can be connected to printers, modems, or other external devices, can be plugged into the back of the computer.

As mentioned earlier, the V-Tech printer is a Seikosha unit which we have previously found to be a satisfactory, cost effective printer. It requires an interface module which measures 5.5" x 2" and plugs into the interface bus on the back of the computer. Since the Seikosha printer uses a standard Centronics parallel signal, presumably other printers with similar signal requirements could be used, although they will probably not reproduce screen graphics correctly.

At CES, V-Tech was showing a nifty, low-cost four-color printer/plotter. We had hoped to bring you a review of it but couldn't lay our hands on one in time to review it in this guide.



Each key produces several outputs.

Documentation

Included with the computer are a 149-page Basic Reference Manual, a 24-page booklet of 21 Basic Application Programs, and an 8-page User Manual describing how to set up the system.

While some of the documentation obviously shows its Chinese (Hong Kong) heritage, the majority is well-written, if not awfully well-edited. The Basic manual provides a good introduction to the rudiments of the language although some of the example programs leave something to be desired (the one to illustrate arrays is particularly bad). POKE and PEEK are explained in only the most cursory way, and we have no idea what the "New Characters Code" chart on Page 104 is for. Also, sadly lacking is an index; it is something that is very useful in a reference manual.

On the other hand, the manual is as good as most and better than many. It is just a shame that documentation is the weak spot of so many otherwise-excellent computers.

Summary

All in all, the Video Technology folks in Hong Kong have done an excellent job producing a versatile small computer. We are impressed with the excellent implementation of Microsoft Basic, full on-screen editing, repeat keys, and easy-to-use graphics features. The idiosyncrasies were a bit annoying, but owners will get used to them and will probably not notice them after a week or two of operation. Bottom line: the VZ200 is a great value for the suggested price of under $100.

Video Technology (U.S.) Inc., 2633 Greenleaf, Elk Grove Village, IL 60007. □

Is Your VIC 20® Complete?

Micro-Ware D.I. offers a full line of unique hardware and software products for the VIC 20® and Commodore 64®.

Universal Tape Interface and Duplicator — A Tymac Product for the VIC 20® and Commodore 64®. Easily load, save and even duplicate tapes with a standard recorder. Full 3 LED Indication of data transfer. Note: Duplication requires 2 standard recorders.....$49.50

Expand-O-Ram — 16K expansion board for the VIC 20®. Contains reset, full memory allocation, 2 switch selectable slots, plus write protect area for cartridge simulation and investigation.....$119.00

Tymac Buffered Printer Cable — For VIC 20® and Commodore 64®. An inexpensive way to connect a parallel printer through the user port. Extensive manual with driver included.....$29.95

The "Connection" — A fully intelligent parallel interface for the VIC 20® and Commodore 64® that will make your printer operate like the Commodore printer including ALL GRAPHICS, and virtually every other printer function. Available for most graphic printers.....$119.00

**Plus! Game Cartridges, Cassettes, Educational, Word Processors, Business Applications and more!!!

BASF QUALIMETRIC™
A TOTALLY NEW DIMENSION OF QUALITY.

From BASF comes a totally new level of excellence in magnetic media – the Qualimetric standard, a standard so advanced that BASF FlexyDisks® are confidently backed by an extraordinary new lifetime warranty. The Qualimetric standard is maintained without compromise through every step of BASF design, production, inspection, and testing...reflecting an unwavering BASF commitment to media fidelity and durability.*

*Our FlexyDisk jacket incorporates a unique two-piece liner that not only traps damaging debris away from the media surface, but also ensures precise media-to-head alignment. The result – certified 100% error-free performance, backed by BASF's exclusive lifetime warranty.**

For information security, tomorrow and beyond, look for the distinctive BASF package with the Qualimetric seal. Call 800-343-4600 for the name of your nearest supplier.

ENTER TOMORROW ON BASF TODAY

BASF BASF

*Contact BASF for warranty details. © 1982, BASF Systems Corporation, Bedford, MA

CIRCLE 103 ON READER SERVICE CARD

PKASO™
Printer Interface Family

and Apple //e...
We work together

PKASO Interfaces come complete with Cable, Instructional Diskette and Comprehensive Manual.

The PKASO family makes you and your Apple Computer a master of text and graphics.

PKASO makes it easy to use the features of your printer—select character sizes, vary line spacing, even print in colors. Simple PKASO commands make these features usable from the keyboard or a program.

PKASO also adds features to your system. Press a few keys and get a snapshot "dump" of the image you see on the screen—text or graphics. Add new characters and symbols that you couldn't print before, using our SuperFont™ system. Add our new PipeLine™ printing buffer and your printer can take its time while you and your Apple move on to the next task. The PipeLine is a modular add-on to the standard PKASO board.

The PKASO interface is designed for Apple II and Apple /// in all the popular configurations. It prints in full color on the IDS Prism Printer, and in striking black on C. Itoh, Centronics, Epson, IDS, NEC, and Okidata matrix printers.

IS PipeLine™
PRINTING BUFFER

For Apple, IBM, TRS-80 and most leading personal computers.

NOW with **serial** as well as **parallel** output and
Random Access Processing
(pat. pending)

Interactive Structures Inc.
146 Montgomery Avenue
Bala Cynwyd, PA 19004
Telephone: (215) 667-1713

Mattel Aquarius Home Computer System

Owen Linzmayer
and David Ahl

Until recently, the name Mattel was associated mainly with children's toys, most notably, the Barbie doll and Hot Wheels. That was before the company decided to take a chance by trying to establish a foothold in the blossoming business of selling home video game systems. If we look at the unquestionable success of the Intellivision, it is apparent that the executives at Mattel made a wise decision.

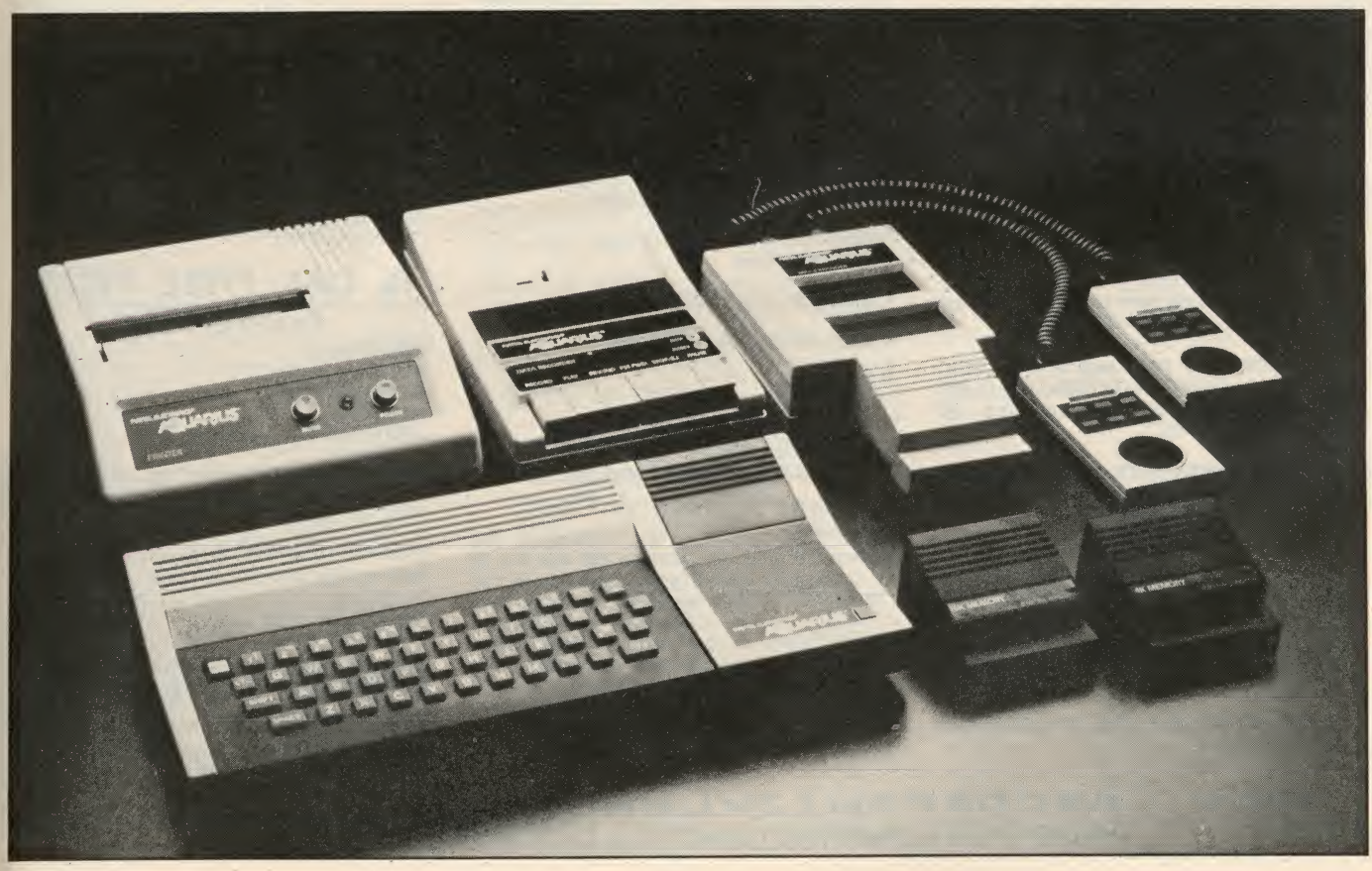
Can Mattel break away from its toy-oriented background? That is the question as Mattel now enters the already crowded home computer market with the Aquarius.

The Aquarius computer console retails for $100-$160, depending upon where you buy it. What exactly do you get for your money? The low-end, no frills Aquarius system features a rubber "Chiclet" keyboard, 4K RAM, a Z80A microprocessor, and a version of Microsoft Basic residing in ROM. You also receive a 10′ video cable, TV switch box, power adapter, and two instruction manuals.

Let's take a closer look at the Aquarius and the peripherals available at the time of this writing.

The Aquarius Computer System at a Glance

Suggested List Price: $159.95
Dimensions: 13.5" x 6" x 2"
RAM: 4K, expandable to 52K
ROM: 8K
CPU: Z80A
Language: Microsoft Basic
Keyboard: 49 keys with shift and control keys
Video Output: 40 x 24 character display
80 x 72 pixel resolution
16 colors



80 COLUMN PRINTER SALE — $179.00*

COM-STAR T/F

Tractor
Friction
Printer

only $219

(Parallel or Serial)

• Lowest price quality tractor friction printer in the U.S.A. • Fast 80 characters per second
• 40, 46, 66, 80, 96, or 132 characters per line spacing • Prints labels, letters, graphs, and tables
• List your programs • Print out data from modem services

*STX-80 COLUMN PRINTER—$179.00

Prints full 80 columns. Super silent operation, 60 CPS, prints Hi-resolution graphics and block graphics, expanded character set, exceptionally clear characters, fantastic print quality, uses inexpensive thermal roll paper!

DELUXE COMSTAR T/F PRINTER—$219.00

The Comstar T/F is an excellent addition to any micro-computer system. (Interfaces are available for Apple, VIC-20, Commodore-64, Pet, Atari 400 and 800, and Hewlett Packard). At only $219 the Comstar gives you print quality and features found only on printers costing twice as much. Compare these features.

• **BI-DIRECTIONAL PRINTING** with a LOGIC SEEKING CARRIAGE CONTROL for higher through-put in actual text printing. 80 characters per second.

• **PRINTING VERSATILITY:** standard 96 ASCII character set plus block graphics and international scripts. An EPROM character generator includes up to 224 characters.

• **INTERFACE FLEXIBILITY:** Centronics is standard. Options include EIA RS232C, 20mA Current Loop.

• **LONG LIFE PRINT HEAD:** 100 million character life expectancy.

• **THREE SELECTABLE LINE SPACINGS:** 6, 8 or 12 lines per inch.

• **THREE SELECTABLE CHARACTER PITCHES:** • 10, 12 or 16.5 characters per inch. 132 columns maximum. Double-width font also is standard for each character pitch.

• **PROGRAMMABLE LINE FEED:** programmable length from 1/144 to 255/144 inches.

• **VERTICAL FORMAT CONTROL:** programmable form length up to 127 lines, useful for short or over-sized preprinted forms.

• **FRICTION AND TRACTOR FEED:** will accept single sheet paper.

• **224 TOTAL CHARACTERS**

• **USES STANDARD SIZE PAPER**

If you want more try —

Premium Quality COMSTAR T/F SUPER-10X PRINTER—$299.00

More Features Than RX-80

For $299 you get all of the features of the Comstar T/F plus 10" carriage 120 cps, 9 x 9 dot matrix with double strike capability for 18 x 18 dot matrix. High resolution bit image (120 x 144 dot matrix), underlining, backspacing, left and right margin settings, true lower descenders, with super and subscripts, and prints standard, italic, Block Graphics, special characters, plus 2K of user definable characters. For the ultimate in price performance the Comstar T/F Super 10" leads the pack!

Double Immediate Replacement Warranty

We have doubled the normal 90 day warranty to 180 days. Therefore if your printer fails within "180 days" from the date of purchase you simply send your printer to us via United Parcel Service, prepaid. We will IMMEDIATELY send you a replacement printer at no charge via United Parcel Service, prepaid. This warranty, once again, proves that WE LOVE OUR CUSTOMERS!

15 DAY FREE TRIAL

OTHER OPTIONS

Extra Ribbons	$ 5.95
Roll Paper Holder	32.95
Roll Paper	4.95
5000 Labels	19.95
1100 Sheets Fan Fold Paper	13.95

Add $17.50 shipping, handling and insurance. Illinois residents please add 6% tax. Add $40.00 for CANADA, PUERTO RICO, HAWAII, ALASKA orders. WE DO NOT EXPORT TO OTHER COUNTRIES. Enclose cashiers check, money order or personal check. Allow 14 days for delivery, 2 to 7 days for phone orders. 1 day express mail available!! Canada orders must be in U.S. dollars.

PROTECTO
ENTERPRIZES (WE LOVE OUR CUSTOMER
BOX 550, BARRINGTON, ILLINOIS 60010
Phone 312/382-5244 to order

SUPER-10" ABCDEFGHIJKLMNOPQRSTUVWXYZ
ABCDEFGHIJKLMNOPQRSTUVWXYZ 1234567890

CIRCLE 125 ON READER SERVICE CARD

Console

The base of the computer measures 13.5″ × 6″ and is molded in a combination of black and off-white plastic. The back of the console is 2″ high but slopes down to a sleek 1″ at the front. The on/off switch is mounted on the righthand side of the computer, and a green LED located on the face indicates when power is flowing.

The Aquarius has a single edge-connector in the rear that allows the user to plug in either program cartridges or accessories such as the Mini Expander module. When the slot is not in use, a dust cover keeps the contacts clean.

The video-out connector is also found on the back, along with the TV channel selector (3 or 4). Situated next to this switch are the cassette and printer I/O ports. The power adapter cable enters the computer at the rear where it is permanently attached.

Keyboard

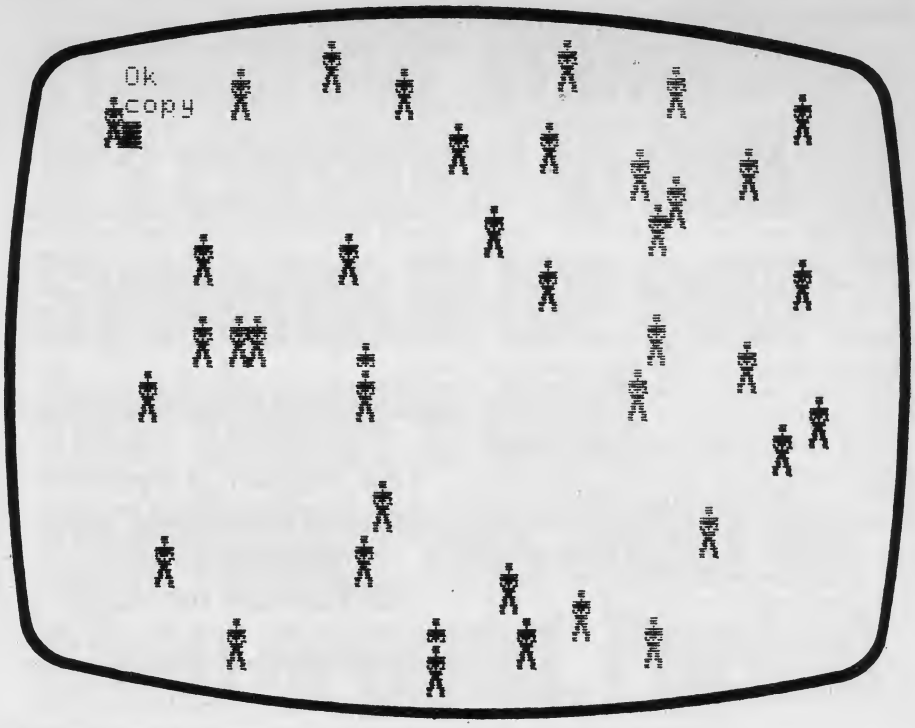
The Aquarius keyboard is a compromise between full-stroke and membrane—what we refer to as "Chiclet" style. Unlike a flat membrane keyboard, each key on the Aquarius protrudes above the surface of the computer. To the delight of smaller children, and to the disappointment of touch typsts, the 49 light blue rubber keys are spaced rather close together. There is a slot on each side of the keyboard so that overlays may be inserted easily.

The current version of Microsoft Basic on the Aquarius leaves much to be desired.

Most of the keys have both lowercase (normal) and uppercase (shift) characters. In addition, the control key provides 34 special keyword abbreviations. This is quite handy because the Aquarius is somewhat prone to key bounce (one press of a key is interpreted by the computer as two or three keystrokes).

Touch typists will find it particularly dificult to adjust to the Aquarius keyboard, mainly because of the positioning of the spacebar. Instead of its customary location, centered on the bottom row, the spacebar is found in the lower left-hand corner of the keyboard. What's more, it isn't even a spacebar. It is a small key. Granted, the space"bar" is larger than most of the other keys, but no bigger than the shift and return keys.

A better bit of keyboard design is seen in the reset key, which is surrounded by raised edges that prevent accidental pressing. If you hit the reset key by mistake, you can sometimes save your program by pressing CTL-C. The manual claims that CTL-C will always enable you to recover a program after pressing reset. Not so; it rarely works when programs use POKE statements.



Screen output for Program 1 as printed on the Aquarius printer.

```
290 PRINTCHR$(11)
300 H=12328
310 A=H+900*RND(1)
320 POKE A,19
330 POKE A+40,20
340 Z=Z+1
350 IF Z<40 THEN 310
360 END
```

Program 1. This short produces 40 little men, each consisting of two graphics characters (characters 19 and 20) that are POKEd *into graphics screen locations in lines 320 and 330.*

Basic Language

The Aquarius comes with a version of Microsoft Basic residing in the 8K ROM. This version has somewhat fewer commands than some other implementations (see Table 1). Mattel plans to offer an Extended Basic upgrade later this year. This is similar to what Radio Shack did with their Color Computer.

The current version of Microsoft Basic on the Aquarius leaves much to be desired by the serious programmer. Probably the biggest inconvenience is that the editing features are extremely limited. If you find a mistake in your program, you must retype the entire line that contains the error.

Screen Output

The Aquarius features an upper- and lowercase text display of 40 × 24 black characters on a blue field. With a one line command, the background and foreground colors can be selected from a pal-

Table 1.

ABS	DIM	LEFT$	ON	RETURN	STOP
AND	END	LEN	OR	RESTORE	STR$
ASC	EXP	LET	PEEK	RIGHT$	TAB
CHR$	FOR	LIST	POINT	RND	TAN
CLEAR	FRE	LLIST	POKE	RUN	THEN
CLOAD	GOSUB	LOG	POS	SGN	TO
CONT	GOTO	LPRINT	PRESET	SIN	USR
COPY	IF	MID$	PRINT	SOUND	VAL
COS	INKEY$	NEW	PSET	SPC	
CSAVE	INPUT	NEXT	READ	SQR	
DATA	INT	NOT	REM	STEP	

ette of 16 colors. Unfortunately, there is no Color command; to color a block, the command is POKE (L,C). L refers to the screen location (13352 to 14311) and C to the color (0 to 15).

Low-resolution graphics characters may also be manipulated within the 40 × 24 screen grid using POKE commands. Fortunately, the character set contains a substantial number of graphics characters (160) in addition to the standard 96 ASCII characters (letters, numbers, symbols). Thus it is possible to achieve reasonable animation on the low-resolution screen.

With the present Basic, the highest graphics resolution available to the user is 80 × 72 pixels. This is achieved by dividing each block on the 40 × 24 grid into six pixels. Unlike the background, you cannot designate the color of a pixel; each pixel within a block of six is the same, although blocks may be individually colored. In this mode, the available commands are PSET(X,Y) to turn on a pixel, PRESET(X,Y) to turn it off, and POINT(X,Y) to determine if it is on or off.

Unfortunately, the Aquarius does not have a clear screen (CLS) command. Instead, you must type PRINT CHR$(11). This is cumbersome, particularly since graphics characters do not automatically scroll off the screen when a listing is done.

```
10 PRINT CHR$(11)
20 C=INT(16*RND(1))
30 I=INT(11*RND(1))
40 P1=13352+40*I+I
50 P2=P1+40-2*I
60 P3=14272-40*I+I
70 P4=P3+40-2*I
80 FOR P=P1 TO P2
90 POKE P,C
100 NEXT P
110 FOR P=P2 TO P4 STEP 40
120 POKE P,C
130 NEXT P
140 FORP=P4 TO P3 STEP -1
150 POKE P,C
160 NEXT P
170 FOR P=P3 TO P1 STEP -40
180 POKE P,C
190 NEXT P
200 N=N+1
210 IF N<20 THEN 20
220 END
```

Program 2. This program produces 20 colored concentric rectangles using low-resolution graphics characters. Points P1 through P4 define the four corners of each rectangle.

```
10 PRINTCHR$(11)
30 I=INT(35*RND(1))
50 X2=79-I
60 Y2=71-I
70 FOR X=I TO X2
80 PSET(X,I)
90 PSET(X,Y2)
100 IF X2-X<=8 THEN 130
110 PSET(I,X)
120 PSET(X2,X)
130 NEXT X
131 C=C+1
140 IF C<20 THEN 30
150 END
```

Program 3. This program also produces 20 concentric rectangles using high-resolution pixels. Note the ease of using PSET *command compared to the* POKEs *in Program 2.*

The Aquarius system comes complete with two excellent instruction manuals.

Manuals

The Aquarius system comes complete with two excellent instruction manuals. The first booklet, entitled "Guide to Home Computing," gives detailed, illustrated directions on how to set up the computer. There are 11 chapters dedicated to introducing the beginner, as well as the more advanced programmer, to the Basic language and the particular features of the Aquarius. This manual is well written and explains each function in simple terms. To aid the learning process, hints, programming tips and examples are abundant. The omission of an index is the only disappointment in an otherwise excellent manual.

The second booklet is really a set of 16 "Simplified Instruction Cards." These pop up and are intended to sit next to your computer for quick and easy reference. If neither manual solves a specific problem, toll-free phone numbers are provided for service information and programming assistance. This is a luxury and is tremendously useful. Unlike the "help" lines of many other computer companies, these two are manned by a staff of knowledgeable and courteous people.

Printer

One of the most useful peripherals for a computer system is a printer. Whether it be for word processing or getting a hard copy of a program listing, a printer is an invaluable tool. The Aquarius printer is just like its computer counterpart: small and simple.

Two blue buttons and a green LED are all that is found on the front panel of the printer. The rightmost button is the power switch, and when the electricity is on, the LED lights up. Depressing the button on the left causes the paper to advance little by little.

The printer requires its own power source. It uses a unique serial interface; a connecting cord is provided. The printer manual claims that the Aquarius thermal printer has an alphanumeric print rate of 80 characters per second (cps) and a graphics print rate of "20 elementary lines per second." I did some of my own testing and found these numbers to be relatively accurate. The thermal printhead consists of a 5 × 7 dot matrix which prints blue characters on white 4 ⅜″ wide paper. The printer can output 40 characters per line, making it fine for listing a program, but a bit unorthodox for serious word processing. The printable characters include upper- and lowercase, as well as special character graphics. On the back of the printer is a three-position sliding switch that designates which mode the printer is in: graphics, mixed, or text.

The Aquarius Printer at a Glance

Price: $165

Dimensions: 7.5" x 8.5" x 3"

Speed: 80 cps alphanumeric, upper/lowercase
20 graphic lines per second

Printhead: 5 x 7 thermal dot matrix

Truckwidth: 40 characters per line

Like most thermal printers, the Aquarius model is fairly quiet.

Like most thermal printers, the Aquarius model is fairly quiet. In fact, most of the noise it produces seems to be caused by the friction feed paper advance system, not the process of printing. When the printer is waiting for input, it is absolutely silent.

The Aquarius printer comes with a small booklet that is in no way a technical manual. Also included with the printer are two rolls of thermal paper—one already installed. By the way, installing the paper in the printer is no easy task. After a bit of practice it does become easier, but it is still something I don't look forward to doing.

Mini Expander

The Aquarius computer comes with only one cartridge slot. The Mini Expander module has slots for both memory

Aquarius, continued...

and program cartridges, two hand controllers, and two additional sound channels.

Designed in a fashion that is consistent with the computer console, the Mini Expander plugs into the cartridge slot and measures 4.5" × 5.5" when installed.

With the Expander, a memory upgrade cartridge can be inserted into the rear slot at the same time that a program cartridge sits in the front slot. I haven't seen it yet, but I assume that the 32K memory cartridge is used in conjunction with the 16K cartridge to provide the system maximum of 52K of RAM.

Mattel advertises each controller as having a 16-position disc, not joystick. This is true—and unfortunate. While those who are accustomed to the Intellivision may not mind the disc, I would much rather have a real joystick. Luckily you have two choices to improve the comfort of the controller: Buy either an Injoy-A-Stick adapter or a set of Thumb Saver cushion pads.

Each controller is detachable and accepts keypad overlays. The keypad consists of six rubber buttons. Why Mattel didn't make the Aquarius controllers compatible with the new Intellivision II controllers is beyond me.

The Aquarius Mini Expander at a Glance

Price: $60

Dimensions: 4.5" x 5.5" x 2"

Features: 2 program/memory cartridge slots,
2 additional sound channels
2 16-position hand controllers with 6 buttons

The response of the controller is very good once handling it is mastered. The cable connecting it to the Expander is a lengthy coil similar to those found on telephone handsets. Although the controllers work well with preprogrammed games, they cannot be accessed by the user from Basic. This is a major drawback for anyone who is interested in using the Aquarius to design game software. A representative at Mattel hinted that the Extended Basic may contain commands to allow the use of the controllers. One can only hope so.

Memory Expansion

As stated earlier, the minimum configuration Aquarius comes with 4K of user RAM. Additional 4K and 16K memory cartridges are now available. These augment the memory that is already permanently installed in the computer. A 32K upgrade is scheduled for release later this year. □

This is our promise: it's cheaper to call Systems IV for your hardware and peripherals than to shop around. Period.

We are creative buyers. We look everywhere and anywhere to keep our prices as low as they can be. We're small. You receive the very finest service from individuals, not departments. We're dedicated. That makes us go to great lengths to supply and satisfy our many customers. Here are some current offerings:

PRINTERS

Okidata 92P	$520.00
Okidata 93P	$839.00
Gemini 10	$320.00
Gemini 15	$459.00
Epson FX-80	$595.00
Epson FX-100	$739.00

EXPANSION BOARDS

Quadram Quadlink	CALL
Quadboards	$350.00-$799.00
MegaPlus AST	$385.00
Super RIO STB	$385.00

MODEMS

Hayes 1200 Smartmodem	$489.00
Hayes Micromodem II	$275.00
Apple Cat	$275.00
Smart Cat	$425.00

Systems IV offers the lowest prices, the best service and the greatest selection of hardware, peripherals and software for whatever computer system you operate—and that's no empty promise.

SYSTEMS IV LTD

1204 Greer's Trail
Peachtree City, GA 30269
Orders and inquiries call: **404-487-7538**
24 hour Bulletin Board: **404-487-6129**

We accept Checks, Money Orders, VISA, MasterCard and American Express.

Prices subject to change without notice.
Dealer inquiries invited.

CIRCLE 135 ON READER SERVICE CARD

CONFESSIONS OF A LOW TECHNOLOGY MAN.

"Choosing a p about as n Until I c

"Six months ago, I started shopping for a personal computer.

It was not a pleasant experience.

Half the sales people sized me up as "low tech" and avoided me like the plague. The other half said things I couldn't understand, showed me machines I couldn't operate without taking a computer class, or gave me demonstrations that had absolutely nothing to do with my business.

I was confused. I was embarrassed. I began to feel like a technological Quasimodo.

TECHNOLOGICAL QUASIMODO

But I was still determined. So I called this friend of mine—Bob Goldman—who's been into computers for years.

"Bobby," I said, "Help!"

He said, "Relax. They've finally built a computer that demands nothing but delivers everything. The Epson. And the only language you need to operate it is the one you've already shown a reasonable mastery of: English."

EPSON???

As usual, Bobby knew what he was talking about. It seems that Epson has become something of a legend in the computer industry by making the world's most reliable computer printer. Today, one out of every two personal computer printers sold worldwide comes from Epson.

Now they've turned their attention to the computer itself. And have engineered a breakthrough that has caught the other computer companies completely off guard:

STATE-OF-THE-ART SIMPLICITY.

That's the best way you could describe the Epson. For instance, the crystal sharp resolution of the screen provides amazing graphics capabilities. (Anyone who's tried to draw a circle and gotten something resembling an octagon knows how important that can be.) Yet, despite its double density disk drives and powerful 256k memory, you don't have to know anything about computers to use the Epson.

No "computerese" to learn. No artificial routines to memorize.

All you have to know is *what you want.*

THE ERA OF PUSH-BUTTON WORK HAS FINALLY ARRIVED.

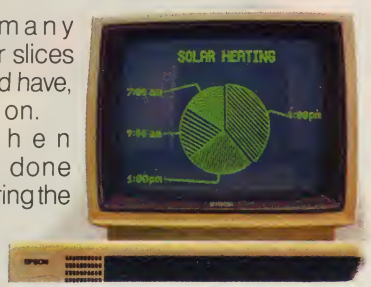
Across the top of Epson's keyboard is a row of keys labeled in simple English.

Each key does exactly what you think it would do.

If you want to draw a graph, for example, you press "Draw." Step-by-step, the Epson asks you what kind of graph, where you want the title

a personal computer was s much fun as having a root canal. I discovered the Epson."

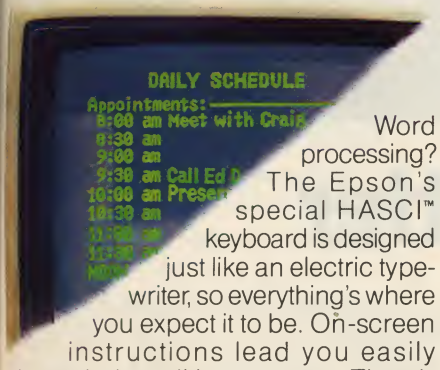
how many bars or slices it should have, and so on.



When you're done answering the questions, it displays the finished graph.

You smirk.

Hit the "Schedule" key and up comes today's electronic appointment calendar, ready for you to check your meeting schedule, make appointments, jot down notes, or update your things-to-do list.



Word processing? The Epson's special HASCI™ keyboard is designed just like an electric typewriter, so everything's where you expect it to be. On-screen instructions lead you easily through the editing process. There's even a "Help" button to bail you out if you get in trouble. Best of all, if you do manage to make a mistake, you simply push "Undo" to back up a step and start over.

In less than a day, I was banging out error-free letters and perfect reports. All of which I was filing *electronically.*

ELECTRONIC FILING, ALONE, MAKES THE EPSON WORTH ITS WEIGHT IN GOLD.

When I finish writing something, I touch "Store." My Epson asks me what I'd like to call the document, then lets me file it away by using up to 16 words.

I could, for instance, file a letter under the title "Letter to Bob Goldman thanking him for recommending the Epson and inviting him to dinner Saturday."

The letter can then be instantly retrieved by telling the Epson to look for "Letter to Bob Goldman," or just "Bob," or even "Saturday dinner." It automatically searches through a vast electronic file drawer to find the letter — using whatever slight bit of information I can remember.

Very slick. Very useful. And nothing like the cumbersome file and retrieve codes demanded by other computers.

In fact, the Epson is so easy to use and undemanding that it's hard to believe that you're on the leading edge of technology.

Yet that's exactly where I find myself. In one day, I was tearing through my work — while guys who've had computers for months (even years) were still tearing through their instruction manuals.

In one day, I was doing more work, faster, and *better* than I ever thought possible.

In one day, this low technology man had caught up with the computer age!

Bobby. . . . Epson . . . it's a nice age. I thank you both."

Naturally, the Epson is expandable to whatever degree of complexity you choose, and accepts a full line of CP/M® software. But for a base price of less than $3,000 it does far more tasks than could possibly be covered here (like sending and receiving electronic mail, juggling complicated travel itineraries, etc.). Rest assured, however, that these are not separate programs you have to buy. They all come with your Epson.

Epson also has a national service network that provides technical support, advice, and information. For a free brochure, or the name of your nearby Epson dealer, call toll-free (800) 421-5426. California residents call (213) 539-9140.

EPSON

STATE-OF-THE-ART...SIMPLICITY.

CIRCLE 156 ON READER SERVICE CARD

CP/M® is a registered trademark of Digital Research Inc.

The Best Just Got Better

Introducing the new Strobe Models 260 and 200 Graphics Plotters. How do you make the world's most cost-effective graphics system even more remarkable? Simple. Make it easier to use, more powerful, more versatile and more attractive. The hard part is doing all of the above while holding the line on a very affordable price. With the new Models 260 and 200 Graphics Systems, Strobe has done it all. And the benefits are all yours.

The Strobe 260 is the first eight-pen plotter and software package available for under $1,000. With just a few keystrokes on your computer, the system produces superb high-resolution charts, drawings and transparencies with up to eight automated color breaks. The even more economical Model 200 produces the same wide range of graphics with a single pen which may be changed manually.

The new Strobe plotters interface with virtually every popular microcomputer made today, including the Apple II, IIe and III, Victor, IBM PC, Kaypro and Osborne systems. What's more, the StrobeWare software programs provide every graphic format you will probably ever need, including multicolor pie charts, bar graphs, line graphs, text processing, and a broad selection of symbols and character styles. To further increase your capabilities, the new Strobe systems also interface with over 40 other popular graphics programs.

Every feature of the new Strobe Graphics System is designed to give you the highest quality graphics quickly, easily and inexpensively. The system also looks very nice on your desk. So visit your local dealer today and see how much better the best can be.

Apple II, IIe and III, Victor, IBM PC, Kaypro and Osborne are trademarks of Apple Computer, Inc., Victor United, Inc., International Business Machines Corporation, Kaypro Corporation, and Osborne Computer Corporation, respectively.

The Strobe Graphics System

Seeing is believing

STROBE INCORPORATED

Strobe Inc.
897 5-A Independence Ave.
Mountain View, CA 94043
415/969-5130

CIRCLE 132 ON READER SERVICE CARD

The TRS-80 MC-10

Too little, too late for too much?

Owen Linzmayer

Not inclined to let the TRS-80 Color Computer fade into obscurity, the executives at Tandy have introduced the Micro Color Computer; better known as the MC-10. This new machine functions like a stripped down Color Computer, but looks like a slightly enlarged Timex Sinclair 1000.

creative computing

HARDWARE PROFILE

Product: TRS-80 Micro Color Computer MC-10

Type: Personal

CPU: 6803

RAM (min/max): 4K/20K

ROM: 8K

Type of keyboard: 47-key "Chiclet"-style

Text resolution: 32 x 16

Graphics resolution: 64 x 32

Number of colors: 8

Sound capability: Yes

Ports: 1500-baud cassette and RS-232C serial I/O

Dimensions (HxWxD): 2"x8.5"x7"

Documentation: 134-page manual and reference cards.

Summary: Will need more than luck to make it.

Price: $119.95

Manufacturer:
Radio Shack - Tandy Corp.
Fort Worth, TX 76102

The MC-10 is appropriately called the Micro Color Computer. Measuring a petite 2" x 7" x 8.5", the MC-10 takes up very little table space. It is so small in fact, that it is almost dwarfed by the CCR-81 Radio Shack tape recorder it uses as a storage device.

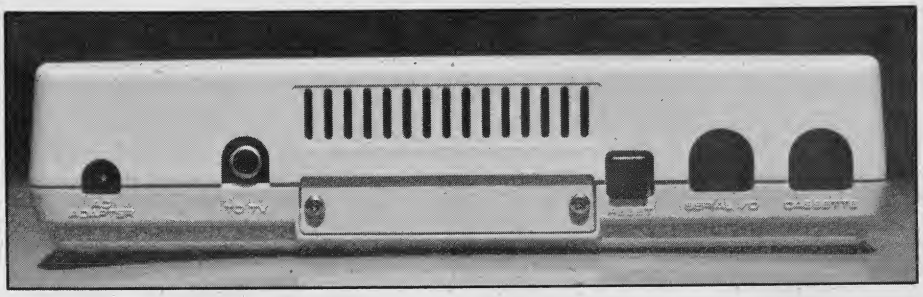
When we look at new computers such as the Timex Sinclair 2000, TRS-80 Model 100, and the TI CC-40, it becomes obvious that computer designers are infatuated with the idea that smaller is better—or at least cuter. The size of the MC-10 supports this theory.

If not for the white plastic case, the MC-10 might very well be mistaken for a Sinclair ZX81 with an improved keyboard. The Micro Color Computer has a 48-key "Chiclet"-style keyboard with almost every key having a normal, shifted, and control value. Using the control key, you can enter entire Basic keywords with only two keystrokes. This is helpful since the keys themselves are so close together that it is virtually impossible to touch type on the MC-10.

Another unfortunate feature of the keyboard is the lack of a shift key on the lefthand side of the keyboard. The control key is positioned right where you expect the second shift key to be located. It is extremely annoying to get the control keyword when you wanted the shifted character instead.

I must say, though, that the MC-10 has a much more responsive and reliable keyboard than that of the Mattel Aquarius

computer of which I was very critical. (Mattel has since introduced the Aquarius II; the same machine with a full-stroke keyboard.)



Rear of MC-10 showing (l-r) AC adapter, video out, reset button, serial I/O, and cassette port.

Rearview

Looking at the back of the MC-10, the first port on the right is a 5-pin DIN connecter for cassette interface. The Micro Color Computer uses the same cables and cords as all of the other TRS-80 computers, thus making the most of the accessories including the tape recorder, compatible. Unlike other Radio Shack computers, the MC-10 does not turn off the cassette motor when not loading or saving.

The MC-10 has a cassette baud rate of 1500; the same as the Color Computer. This might lead you to believe that you can transfer programs back and forth between the two machines—well you can, and you can't. Although you can load the same Basic program on both computers, each interprets the keywords, functions, and commands differently because of the tokens used. This means that except for the line numbers and variable names, the Basic programs are completely changed. See Figure 1 for an example of this.

If I were a knowledgeable machine-language programmer, I would immediately write a transfer utility to rectify this problem by converting the token values. I sincerely hope that Tandy will supply such a program, but I am not optimistic.

To the left of the cassette socket is the RS-232C serial I/O port. Using a 4-pin DIN to male DB-25 cable, you can connect the MC-10 directly to a modem, printer, or another computer that has serial communication capabilities. Adjacent to the serial I/O port is a large red reset button. If the MC-10 ever "hangs up" while in operation, pressing the reset button usually returns control to the user without violating memory.

Centrally located on the rear of the computer is a 34-pin edge connector that is hidden from view behind a removable metal cover. This connector is the expansion port of the MC-10, and as far as we are told, the 16K RAM memory module is the only thing that plugs in here. It might also be used as a program cartridge slot, but Radio Shack refuses to elaborate on this.

Also found on the back of the unit are the RCA video out connector and the AC power adapter plug. The MC-10 outputs its video signal to television channels 3 or 4. The channel select switch is located on the bottom of the computer. The power for the MC-10 does not come directly from a wall socket; it must first pass through an AC adapter which is included in the computer package. The MC-10 uses a non-standard transformer—120V in, 8V out at 1.5A.

The power is turned on and off with a sliding switch found on the righthand side of the computer. Unfortunately, there is no power indicator anywhere on the unit. This is one of the shortcomings of the original Color Computer that has somehow survived the evolution process.

The Insides

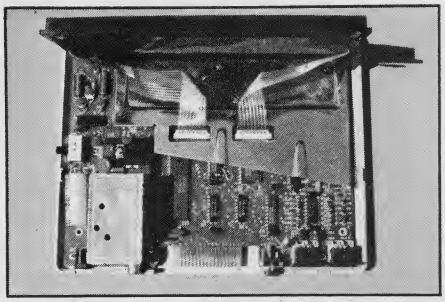
Advertised as "'the perfect choice for computer beginners," the MC-10 costs $119.95 and comes with 4K of user RAM. While this may be a sufficient amount of memory for a novice, if you want to write larger programs, a 16K RAM module costs an additional $50.

With the plug-in module installed, the MC-10 realizes its maximum—20K of user RAM. If 20K doesn't seem like much in a world of new machines starting with 64K, that is because it is not. A comparable system, the long awaited Timex Sinclair 2000 computer, is capable of high-resolution color graphics and comes with 40K RAM. The Timex is supposed to be expandable to 72K and will initially cost around $150.

Our benchmark tests prove that using an 8-bit Motorola 6803 microprocessor, the MC-10 performs arithmetic computations in Basic 10% faster than the Color

ABS	LPRINT
ASC	MEM
CHR$	MID$
CLEAR	NEW
CLOAD	ON..GOSUB
CLOADM	ON..GOTO
CLOAD*	PEEK
CLS	POKE
CONT	POINT
COS	PRINT
CSAVE	PRINT TAB
CSAVE*	PRINT@
DATA	READ
DIM	REM
END	RESET
EXEC	RESTORE
EXP	RETURN
FOR/NEXT	RIGHT$
GOSUB	RND
GOTO	RUN
IF/THEN	SET
INKEY$	SGN
INPUT	SKIPF
INT	SIN
LEFT$	SOUND
LEN	STOP
LET	STR$
LIST	SQR
LLIST	TAN
LOG	VAL

Figure 2. MicroColor Basic commands, statements, and functions.



Interior view of MC-10.

Figure 1.

```
10 CLS 0
20 FOR J = 0 TO 7
30 T = J * 16
40 FOR D = 0 TO 31
50 X = 134
60 PRINT CHR$(X+T);
70 NEXT D
80 NEXT J
90 END
```

MC-10 sample program.

```
10 RESET 0
20 FOR J [ 0 EXEC 7
30 T [ J STEP 16
40 FOR D [ 0 EXEC 31
50 X [ 134
60 DATA COLOR(XTHENT);
70 END D
80 END J
90 INPUT
```

Same program loaded into Color Computer.

Computer without sacrificing accuracy. This means either that the MC-10 has less overhead in Basic, or that the 6803 has a faster clock rate than its older brother, the 6809. Both of these chips are from the same 6800 family.

The MC-10 has a text resolution of 16 lines, with up to 32 characters per line. Like the Color Computer, it displays lowercase characters in inverse video. The highest graphics resolution directly accessible through Basic is 64x32 pixels. You can have all eight colors on the screen at the same time, but it is impossible to mix two colors within the same character block. This limits the animation capabilities of this lo-res machine. High-resolution graphics are, however, possible through POKEs and machine language programming. The video display is very crisp and precise with none of the flickering or ghost effects that are so common on other low-end computers.

The MC-10 uses a Basic interpreter written by Microsoft called MicroColor Basic. This version of Basic is very similar to the non-Extended Color Basic found on the Color Computer. See Chart 2 for a list of the MicroColor Basic commands, statements, and functions. Text oriented programs written for the Color Computer that use less than 4K should convert easily to the MC-10. Unfortunately, because of the cassette problem mentioned earlier, you must key the programs in by hand.

Documentation

The MC-10 comes with a quick reference card in addition to a 133-page "Operation and Language Reference Manual." The manual is easy to read, but does not take enough time to explain thoroughly the Basic commands. It is not written in the "cutesy" manner as are the TRS-80 Model I instruction guides. It should be noted that this manual contains very little technical or hardware material. If you are a serious hacker, you will have to do your own experimentation and exploration.

It is unfortunate that Radio Shack did not introduce the MC-10 during the first few months of 1983, before the computer price battle escalated into a full-scale war. The cut-throat competition between manufacturers has caused drastic drops in computer prices. You can buy a ZX81 for under $50, an Atari 400 for less than $100, and a TI 99/4A for about the same amount. All of these machines are on their way out, but they still represent tremendous values in today's market.

I do not understand how Tandy expects to sell many Micro Color Computers for $119 when more powerful machines with established software bases are retailing for much less. I wish the MC-10 luck, but I have a feeling it needs much more than luck to make it. □

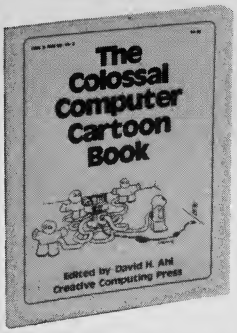
CREATIVE COMPUTING PRESS

books to challenge, entertain and stretch your imagination!

WRITE YOUR OWN APPLE GAMES

Teaches you all the skills you need to start designing your own original computer games. Through the 40 pre-programmed games provided, you'll learn game design basics like movement, scoring, random numbers and time delay. You can then use these techniques to create countless action games, word games, puzzles, science adventures and more. Writing your own games is not only fun, it helps you to fully master the numerical and graphic capabilities of your Apple. The concepts in this book can be grasped by the novice, yet can provide stimulating challenges to more advanced computer buffs.

8½" x 11", softcover, $12.95 ($2.00). **#2W**

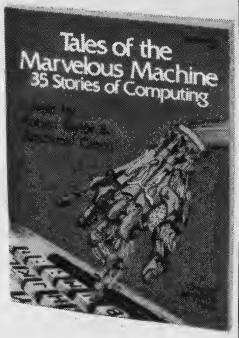


THE COLOSSAL COMPUTER CARTOON BOOK

Edited by David H. Ahl. The best collection of computer cartoons and comic strips around! In 15 subject areas, 36 cartoonists poke fun at robots, computer dating, programmers, glitches, computer games, computers in the office, lab and home—and much more!

8½" x 11", softcover, $5.95 ($1.00). **#6G**

TALES OF THE MARVELOUS MACHINE



A superb anthology of fiction edited by Robert Taylor and Burchenal Green. In these 35 thought-provoking stories, writers such as Frederick Pohl, Charles Mossman, Carol Cail and George Chesbro explore a variety of themes involving computers and the future, computers in society, and the relationship between humans and computers. Can computers wish? Can men fall in love with computers? Could computers take over the world? Are we all part of a large organic computer? Read TALES OF THE MARVELOUS MACHINE and find out!

8½" x 11", softcover, illustrated, $7.95 ($1.50). **#12B**

USE COUPON OR CALL TOLL FREE TO ORDER TODAY!

CREATIVE COMPUTING PRESS Dept.HA4B 39 E. Hanover Ave., Morris Plains, NJ 07950

Send me the books listed below:

ITEM NO.	QTY.	TITLE	PRICE EACH	P & H* ( )	TOTAL
*Outside USA add $3.00 per order.		CA, NJ and NY STATE residents add applicable sales tax:			
				TOTAL AMOUNT:	

☐ **PAYMENT ENCLOSED** $_____

☐ **CHARGE MY:** ☐ American Express ☐ MasterCard ☐ Visa
(Charge and phone orders: $10 minimum.)

Card No._____ Exp. Date_____

Signature_____

Mr./Mrs./Ms._____
(please print full name)

Address_____ Apt._____

City_____ State_____ Zip_____

For faster service, **CALL TOLL FREE: 800-631-8112.** (In NJ call 201-540-0445)

Texas Instruments 99/4A

Steve Arrants

Beset with problems from the start, the TI 99/4 was slow to take off. The keyboard was difficult to use, it was too expensive, and it could not be expanded. The only language available was Basic, and software consisted of plug-in modules.

Dropping from a price of $1100 in 1979, to less than $150 today, the TI 99/4A has come the distance. The 99/4A features a 16-bit microprocessor, and color graphics that make other manufacturers drool. A limited typewriter style keyboard is standard, offering upper- and lowercase. Keys may be used in three ways—upper- or lowercase, and as function keys. Keys may be redefined by software, adding to their versatility.

A Peripheral Expansion System was made available this year, allowing additional memory and access to disk-based software and versatile printers. A speech synthesizer makes the TI 99/4A one of the few home computers capable of true speech.

The real changes have occurred inside. A new Video Display Processor and a revised operating system aid in the creation of sprites—special graphic characters—and their animation. With the addition of an Extended Basic cartridge, creation of sprites is easily done. All of this work is done by the new VDP Processor—the CPU is left free to work on other information. The CPU initiates sprite action, but the VDP handles everything else.

TI now also provides an editor and assembler module which includes a plug-in cartridge and a disk. This very powerful package allows the user to perform many of the operations previously available only on TI's 990 series minicomputers. Among the features are an Editor which works like a word processor for assembly listings. When so much of the "busy work"

The TI 99/4A.

creative computing

HARDWARE PROFILE

Product: TI 99/4A

Type: Home computer

CPU: TI 9900 16-bit

RAM (min/max): 16/52

ROM: 26/56

Type of keyboard: Typewriter

Text resolution: 24 x 32

Graphics resolution: 192 x 256

Number of colors: 16

Sound capablity: Yes

Ports: 2 game ports, cassette port, peripheral port.

Dimensions (HxWxD): 15" x 10 1/2" x 2 3/4"

Documentation: Good

Summary: Support from TI is excellent. Software only available through TI, which may be a problem.

Manufacturer:
Texas Instruments, Inc.
Lubbock, Texas 79408

Plug 3,000 new applications into your Apple®

THE CP/M Card™ plugs CP/M Plus™ into your Apple.
The CP/M Card gives you the option of running your Apple II with the speed and capability of a professional Z-80 system with CP/M®-compatible software. You plug in the CP/M Card. Then choose CP/M or your standard Apple software at your option.

Plug into a big, new world of software.
The CP/M Card gives you instant access to the world's largest selection of microcomputer software—more than 3,000 CP/M-compatible applications, languages, and programming utilities. So, you, too can use professional business programs such as WordStar,® SuperCalc,™ Condor,™ and other high-performance software from Day One. Yet, you still have access to your present library of Apple software.

Plug into incredible performance.
Together, the ultra-fast CP/M Card and CP/M Plus run applications up to 300% faster than your Apple system! The CP/M Card is the only Apple II performance package that offers the speed and efficiency of CP/M Plus.

A plug about quality.
The CP/M Card was designed and built by Digital Research, the creators of CP/M, and Advanced Logic Systems, the most respected manufacturer of Apple performance products. So you know the CP/M Card is the most perfectly integrated Apple performance package you can buy.

Why just keep plugging along? The CP/M Card provides everything you need—including 64K of on-board memory, CP/M Plus, CBASIC,® GSX™-80 and full documentation—for just **$399.**
Now available through the CP/M library.
See your local microcomputer dealer today. Or contact Advanced Logic Systems, 1195 East Arques Ave., Sunnyvale, CA 94086 (800) 538-8177. (In California (408) 730-0306.)

Advanced Logic Systems

The CP/M Card for your Apple II.
Also available for the Apple IIe.

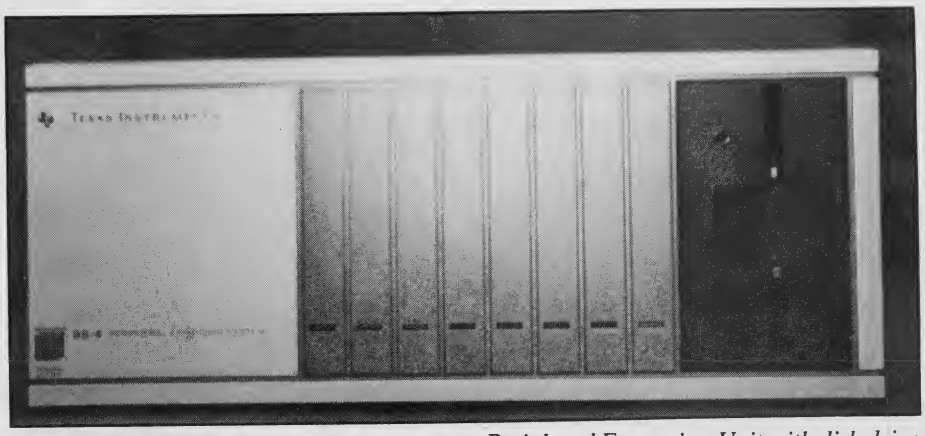
CP/M, CP/M Plus, the CP/M Card and CBASIC are either trademarks or registered trademarks of Digital Research Inc. Z-80 is a registered trademark of Zilog, Inc. WordStar is a registered trademark of MicroPro International Corporation. SuperCalc is a trademark of Sorcim Corporation. Condor is a trademark of Condor Computer Corporation. GSX-80 is a trademark of Graphics Software System. Apple is a registered trademark of Apple Computer, Inc. ©1982 Digital Research Inc.

CIRCLE 105 ON READER SERVICE CARD

has been eliminated, the programmer is free to concentrate on writing better code. The written code is relocatable and linkable. You needn't worry about absolute addresses. Programs can be written in modules, later linked by a loader. Subroutines can be kept on a disk and called into a program when needed.

Users can also access utility routines kept in ROM and GROM. Again, TI has simplified difficult programming tasks. All that needs to be done is to define parameters and then to call them with utility routines.

The TI 99/4A has a new look this year.



Peripheral Expansion Unit with disk drive. Peripheral cards plug in through the top.

The familiar black and silver has been replaced by grey, making it appear sleeker. New peripherals are also available. All Hex-bus peripherals designed to work with TI's new CC-40 portable computer will work on the 99/4A. One new peripheral is the Wafertape storage system. Using tiny cassettes, the Wafertape system quickly loads programs into memory. It is different from regular cassettes in that it can search and find a particular program on the tape. At a suggested retail price of $140, it is considerably cheaper than a disk drive and controller. Other new peripherals include a low-cost four-color printer/plotter, and an inexpensive modem.

Milton Bradley, a software supplier to Texas Instruments, has the MBX Expansion System for the 99/4A. This system provides voice recognition capabilities, and ten software packages have been developed for it. Suggested retail price for the MBX Expansion System is $129.95.

Software for the 99/4A has been a problem in the past. With TI's commitment to this machine, however, this is changing. More software is being made available for the TI 99/4A. Cartridges, cassettes, and disks of popular programs are made by many software manufacturers. Unfortunately, TI has recently announced that a proprietary chip must be used in software cartridges. This special chip is available *only* to TI. In other words, TI has the final word on all software for its machine. Can a computer remain viable under this circumstance? Can TI successfully produce software for the 99/4A? Only time and the marketplace will tell.

The current low price coupled with rebate and free software offers make the 99/4A a good value. Looking at the specifications, it is clear that the TI 99/4A is a powerful and unique machine. It may yet surprise industry experts. □

Experience the Real Potential of a Small Computer

Introducing the first low cost computer system with **FORTH** in Read Only Memory (ROM).

FORTH enables real-time measurements and control, interactive development, and customized keyword vocabularies.

- **SCIENTIFIC/LABORATORY**
- **ELECTRONIC ENGINEERING**
- **MECHANICAL ENGINEERING**
- **PERSONAL COMPUTING**
- **ROBOTICS**
- **TEST AND MEASUREMENT**

CALL NOW

Try it, on us!

(800) 523-2909
(215) 932-4807 in PA

Starter Kit $175.00
with Expanded Memory

Jupiter Ace -
FORTH Programming Training Guide ... $ 14.95

Computer Distribution Associates
17 South Main St. Pittsford, NY 14534

CIRCLE 143 ON READER SERVICE CARD

CREATIVE COMPUTING

WIN AN ATARI® SWEEPSTAKE

Save up to 33% on *Creative Computing*, too!

The Creative Computing Sweepstakes is open to all our readers. No purchase is necessary—and you'll receive a fantastic Atari home computer system worth over $1600 if you're the lucky winner!

How the Sweepstakes works

Just mail the attached card or the coupon below after filling in your name and address. Be sure to indicate whether you're also subscribing to *Creative Computing* at the special rates shown—you can save as much as 33%.

Then, if you win, you'll get a superb Atari personal computer system: the Atari 800 with 16K RAM and 10K ROM...an 810 Disk Drive... a 16K RAM Memory Module for extra memory... a pair of Joystick Controllers for game interaction. Use the Atari to handle small business and professional applications as well as sophisticated home pro-

business accounting, play video games. Programmable in Basic or Assembly, the 800 can use all Atari peripherals and can control up to four disk drives and a 60 lpm printer. In all, the 800 and its accessories form a package worth a full $1620 at retail!

You're sure to win with *Creative Computing!*

Whether you win our Sweepstakes or not, the hours you spend with a computer are certain to be winners when you subscribe to *Creative Computing*. It's the Number One magazine of computer applications and software—filled with in-depth evaluations of computers, peripherals and software, plus applications and software that you can run directly on your computer.

Why not enjoy a year or more of *Creative Computing* at our low introductory prices? You'll save up to 33% if you subscribe at the same time you enter our Sweepstakes!

d trademark of

CREATIVE COMPUTING SWEEPSTAKES

OFFICIAL ENTRY FORM

Save up to 33% on *Creative Computing!*

☐ **YES!** Enter my name in the Creative Computing Sweepstakes and start my subscription to *Creative Computing* for the term checked:

- ☐ One year (12 issues) only $19.97—20% off!
- ☐ Two years only $36.97—26% off!
- ☐ Three years only $49.97—33% off!

Savings based on full one-year subscription price of $24.97.

CHECK ONE: ☐ Payment enclosed. ☐ Bill me later.

☐ **NO** I don't wish to subscribe now, but tell me if I've won the Creative Computing Sweepstakes.

Mr./Mrs./Ms. _____ 4X126
(please print full name)

Address _____ Apt. _____

City _____ State _____ Zip _____

Add $5 a year in Canada; all other foreign add $10 per year. Please allow 30 to 60 days for delivery of first issue.

CHECK ONE:
☐ Payment enclosed.
☐ Bill me later.

4X126

_____

Apt. _____

_____

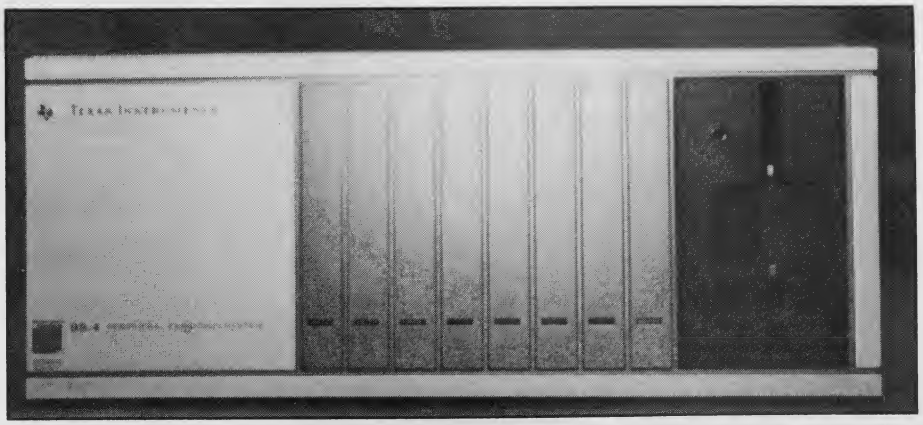
days for delivery of first

NO PURCHASE REQUIRED—ENTER TODAY!

has been eliminated, the programmer is free to concentrate on writing better code. The written code is relocatable and linkable. You needn't worry about absolute addresses. Programs can be written in modules, later linked by a loader. Subroutines can be kept on a disk and called into a program when needed.

Users can also access utility routines kept in ROM and GROM. Again, TI has simplified difficult programming tasks. All that needs to be done is to define parameters and then to call them with utility routines.

The TI 99/4A has a new look this year.



Peripheral Expansion Unit with disk drive. Peripheral cards plug in through the top.

The familiar black and silver has been replaced by grey, making it appear sleeker. New peripherals are also available. All Hex-bus peripherals designed to work with TI's new CC-40 portable computer will work on the 99/4A. One new peripheral is the Wafertape storage system. Using tiny cassettes, the Wafertape system quickly loads programs into memory. It is different from regular cassettes in that it can search and find a particular program on the tape. At a suggested retail price of $140, it is considerably cheaper than a disk drive and controller. Other new peripherals include a low-cost four-color printer/plotter, and an inexpensive modem.

Milton Bradley, a software supplier to Texas Instruments, has the MBX Expansion System for the 99/4A. This system provides voice recognition capabilities, and ten software packages have been developed for it. Suggested retail price

Experi
o

Introducing the firs
computer system wit
Only Memory (ROM)

FORTH enables re
measurements and c
development, and cu
vocabularies.

- **SCIENTIFIC/L**
- **ELECTRONIC**
- **MECHANICA**
- **PERSONAL C**
- **ROBOTICS**
- **TEST AND M**

Co

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 66 BOULDER, COLORADO

POSTAGE WILL BE PAID BY ADDRESSEE

creative computing
sweepstakes
P.O. Box 5215
Boulder, Colorado 80321

CREATIVE COMPUTING

WIN AN ATARI® SWEEPSTAKE

Save up to 33% on *Creative Computing*, too!

The Creative Computing Sweepstakes is open to all our readers. No purchase is necessary—and you'll receive a fantastic Atari home computer system worth over $1600 if you're the lucky winner!

How the Sweepstakes works

Just mail the attached card or the coupon below after filling in your name and address. Be sure to indicate whether you're also subscribing to *Creative Computing* at the special rates shown—you can save as much as 33%.

Then, if you win, you'll get a superb Atari personal computer system: the Atari 800 with 16K RAM and 10K ROM...an 810 Disk Drive... a 16K RAM Memory Module for extra memory... a pair of Joystick Controllers for game interaction. Use the Atari to handle small business and professional applications as well as sophisticated home processing functions—and, of course, for entertainment. Analyze your investments, learn languages, do business accounting, play video games. Programmable in Basic or Assembly, the 800 can use all Atari peripherals and can control up to four disk drives and a 60 lpm printer. In all, the 800 and its accessories form a package worth a full $1620 at retail!

You're sure to win with *Creative Computing!*

Whether you win our Sweepstakes or not, the hours you spend with a computer are certain to be winners when you subscribe to *Creative Computing*. It's the Number One magazine of computer applications and software—filled with in-depth evaluations of computers, peripherals and software, plus applications and software that you can run directly on your computer.

Why not enjoy a year or more of *Creative Computing* at our low introductory prices? You'll save up to 33% if you subscribe at the same time you enter our Sweepstakes!

Atari is a registered trademark of Atari, Inc.

OFFICIAL RULES

No Purchase Necessary

1. On an official entry form or a 3" x 5" piece of paper, hand-print your name, address and zip code. Enter as often as you wish, but mail each entry separately to Creative Computing Sweepstakes, P.O. Box 5215, Boulder, Colorado 80322. Entries must be received no later than December 31, 1983, and the drawing will be held by January 28, 1984. All entries become the property of Creative Computing, which reserves the right to reprint the name and address of the winner.
2. The winner will be selected in a random drawing from among all entries received, under the supervision of the publishers of Creative Computing, whose decision will be final. Only one prize will be awarded in this Sweepstakes. Winner will be notified by mail and may be required to execute affidavit of eligibility and release. Odds of winning will depend on the number of entries received. Creative Computing will arrange delivery of prize. Taxes are the responsibility of the winner. Any manufacturer's claims and warranties will apply, but Creative Computing makes no claims or warranties with regard to any prizes. Prize is not transferable. No substitutions for prizes.
3. Sweepstakes open to all residents of the U.S., its territories and possessions, except employees (and their families) of Creative Computing, its affiliates, and its advertising and promotion agencies. Void wherever prohibited or restriced by law.
4. For the winner's name, send a stamped, self-addressed envelope to Creative Computing Sweepstakes, Circulation Department, One Park Avenue, New York, N.Y. 10016.

OFFICIAL ENTRY FORM

Mail to: **Creative Computing Sweepstakes**
P.O. Box 5215, Boulder, Colorado 80322

☐ **YES!** Enter my name in the Creative Computing Sweepstakes and start my subscription to *Creative Computing* for the term checked:

- ☐ One year (12 issues) only $19.97—20% off!
- ☐ Two years only $36.97—26% off!
- ☐ Three years only $49.97—33% off!

Savings based on full one-year subscription price of $24.97.

☐ **NO** I don't wish to subscribe now, but tell me if I've won the Creative Computing Sweepstakes.

CHECK ONE:
☐ Payment enclosed.
☐ Bill me later.

4X126

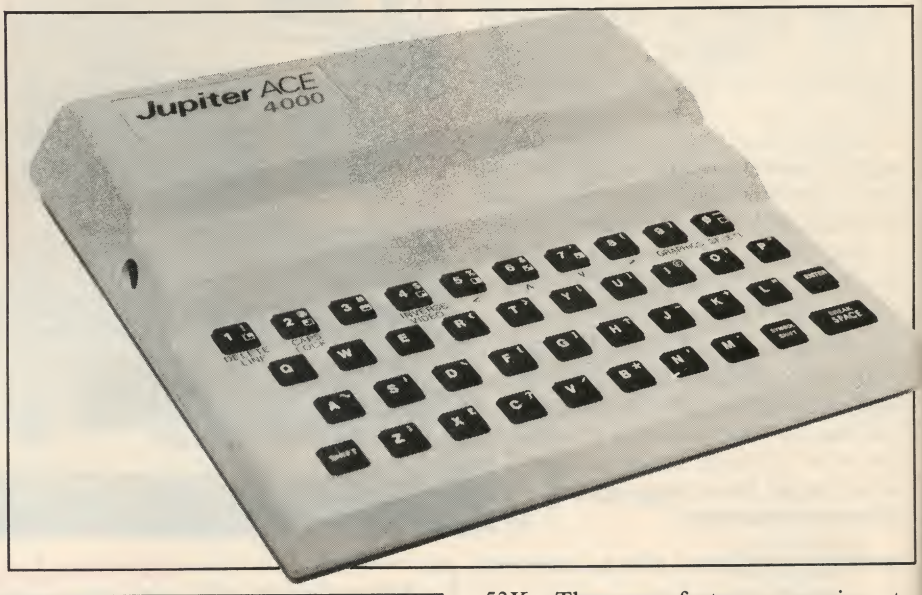
Mr./Mrs./Ms._____
(please print full name)

Address_____ Apt._____

City_____ State_____ Zip_____

Offer valid only in the U.S., its territories and possessions. Please allow 30 to 60 days for delivery of first issue if you subscribe.

The Jupiter Ace: A Forth Computer



Christopher Helck

No matter how you look at it, the Jupiter Ace, manufactured by Jupiter Contab Limited, is a small machine. Measuring 8 1/2" by 7 1/2" by 1 1/2", it is slightly larger than the Timex Sinclair. The price is also small. The machine is available by mail order for $150 from Data-Assette of Oxford, PA.

The most interesting thing about the Ace is that it comes with the Forth programming language in ROM. This means that when you turn the machine on, Forth, not Basic, is running. Because there is not much software currently available to run on this machine, those who buy it are buying an opportunity to learn to program in Forth, one of the up and coming microcomputer languages. A selection of games and programming tools is promised in the near future should you yearn for other diversions once Forth is mastered.

The Keyboard

Almost half of the surface of the Jupiter Ace is covered by its keyboard. The keyboard consists of sculpted rubber keys under which lies a flat keyboard. It is much easier to type on than the flat plastic membrane on the Timex and the Atari 400. That is not to say that it rivals the keyboard of a typewriter—the keys rock a little bit while you are typing.

The space bar has become just another small key beneath the enter key, and a special symbol shift key is used to access punctuation. Overall, the keyboard has a nice feel, although those accustomed to full-sized keyboards will find it a bit cramped.

The computer itself is housed in a stylish grey case and is a breeze to set up. It comes with an American plug adapter, a video cable with an RF modulator, a monitor output and two lines for hook-up to a cassette recorder. An ON/OFF switch would be a welcome addition. At the present time, to shut the machine off you must pull the plug.

The Ace is built around a Z80 microprocessor. It comes with 8K of ROM and 3K of RAM, expandable to 53K. The manufacturer promises to make 16K and 48K memory expansion modules available soon for $50 and $125 respectively. There are two card slots on the back. One is the Z80 pinout and the other is an edge connector that will support the memory expansion packs and an RS-232C interface

The Ace is designed to be hooked up to a cassette recorder. A printer can also be added. The writers of the manual seem to be encouraging adventurous hardware designers to let their imaginations run wild and build exciting new peripherals. There is an example in the manual of how to hook up a traffic light controller. A built-in speaker allows beeps and even musical tones to be played.

Christopher J. Helck, Children's Computer Workshop, 1 Lincoln Plaza, New York, NY 10023.

The rear view reveals the Z80 pinout and an edge card connector.

Forth And The Jupiter Ace

Forth is an interpretive language which is gaining popularity. At its best, Forth is fast and compact; at its worst, it is unreadable. For numerical calculations, it uses reverse Polish notation—to add 3 to 2 enter

3 2 +

rather than the more logical

3 + 2.

Instead of writing programs as in Basic, what you do on the Jupiter Ace is to write words in Forth. These words may then be used in other Forth words. For instance, once a square root function has been defined, it may be used anywhere, anytime, either in another word or interactively. As each word is defined in Forth, it is appended to the dictionary.

The Forth that comes with the Ace is a subset of Forth 79. The power of this small subset is a tribute to the strength of Forth. With the words included, an enterprising programmer could write a version of Basic if he so chose.

One or two additions to the standard vocabulary are worth mentioning. The Ace allows you to inspect and modify old words that have gotten buried within the dictionary without disturbing the words on top. In standard Forth, you would have to recompile the dictionary all over again.

The words IN and OUT are of potential interest to people like myself, who are intimidated by hardware and yet feel they should know something about it. IN and OUT allow you to read and write the input and output ports of the Z80. I haven't had the nerve to connect anything to the 80 pinout yet, but I am far more likely to do that than I would be to attach something to my IBM PC. Maybe I would even learn something.

The Ace version of Forth has its limitations as well as its advantages. The most important is that there are fewer than 1000 bytes of usable space to work with in the 3K version. This is not enough to write even a bad version of Pac-Man. In addition, the compiler is rather severe; it tends to wipe out the system when it runs into trouble. The main problem, however, seems to be in the user interface. After you type a line and hit ENTER, the computer tries to interpret the entire line, including the garbage to the right of the cursor (which is there because you did not bother to erase it when you backspaced) as a command. I found this very frustrating. On the other hand, the Ace does include a fairly nice line editor, and if you use it correctly, you won't have any garbage to the right of the cursor.

Related to this problem is the question, "Where is the input line?" When the machine is brought up, the input line is at the bottom of the screen, which is where we come to expect it. However, certain commands move the input line about on the screen, leaving chaos in their wake.

Graphics On The Ace

The display is black and white. There are two display modes: a character mode, which provides 23 lines of 32 characters, and a graphics mode, which provides 46 lines of 64 pixels. The character set is defined in RAM, and it is amusing to play with it.

The only graphic command that the Ace supports is a point plotting routine; there are no line drawing commands built in. You can key in a Forth word, DRAW, for drawing lines. This command is described in the manual, along with a detailed explanation of how it works.

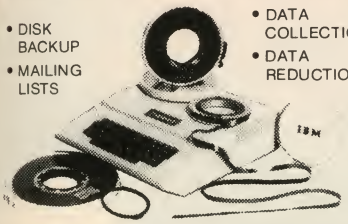
Overall, the manual is well written. It has some of the best beginner's explanations of some of the more difficult Forth words that I have seen anywhere. Everything it explains, it explains well.

In conclusion, the Jupiter Ace is a nicely designed but limited computer that is appropriate for people who want to learn to program in Forth. It is nice to have a computer that does what it is supposed to do—even if what it does is limited. Small can sometimes be beautiful.

Data-Assette, 56 South 3rd St., Oxford, PA 19363. (800) 523-2909. □

APPLE 9 TRACK TAPE DRIVES

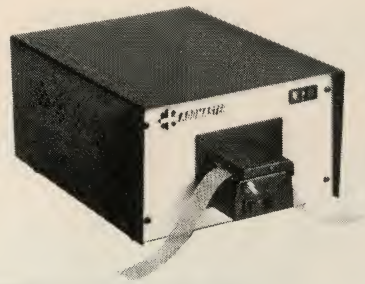
EXCHANGE DATA WITH MINIS & MAIN FRAMES



- DISK BACKUP
- MAILING LISTS
- DATA COLLECTION
- DATA REDUCTION

- 800 BPI NRZI DRIVES WITH CONTROLLER AND SOFTWARE ..... From $1500
- Controller and Software Alone $900
- 1600 BPI PE ..... Call
- Request Full Brochure

ELECTROVALUE INDUSTRIAL INC.
P.O. BOX 376-BG
MORRIS PLAINS, NJ 07950
Formerly Electravalue Industrial
201/267-1117



RS232C Computer compatible Paper Tape Transmitter/Model 612

Stops and starts on character at all speeds, uses manual control or X-on, X-off 90-260 volt, 50-60 Hz power. 50-9600 baud, up to 150 char/sec synchronous or asynchronous; gated internal or external clock, RS 232C, current loop or parallel output, reads 5-8 level tape, 7-11 frames per character, even or odd parity. Desk top or rack mount.

Addmaster Corporation, 415 Junipero Serra Drive, San Gabriel, CA 91776, (213) 285-1121, Telex 674770 Addmaster SGAB

CIRCLE 101 ON READER SERVICE CARD

SOFT SAVE TO 45% WARE

APPLE · IBM · ALTOS · NEC · ATARI · CROMENCO · DEC · HEATH · SANYO
DYNABYTE · TI · VICTOR · SUPERBRAIN · VIC 20 · HIGH TECHNOLOGY
VIC 64 · TIMEX · TELEVIDEO · WANG · XEROX · CP/M · CP/M 86 · LIFE BOAT

HOME ACCOUNTANT	$ 55	*COMPUTERS*	
PFS: FILE	69	SYSCOM II (APPLE COMP)	$ 695
VISICALC	165	COMMADORE 64	499
PFS: REPORT	69	ALTOS-DYNABYTE-NEC	$ CALL
dBASE II	407	EAGLE II W/$1000 SOFTWARE	2320
SCREENWRITER II	90	FRANKLIN ACE 1000	995
WORDSTAR	309	SANYO W/$2000 SOFTWARE	1549
MULTIPLAN	189	NORTHSTAR	$ CALL
D.B. MASTER	159	XEROX	$ CALL
LETTER PERFECT/MAILMERGE	105	TELEVIDEO	$ CALL
SUPERCALC	189	BURROUGHS B10	$ CALL
PFS: GRAPH	87	IBM PC	$ CALL
VISIFILE	205	APPLE II	$ CALL
1ST CLASS MAIL	125	*PRINTERS*	
SPELL WIZARD	56	MX 80/FT	$ 475
SENSIBLE SPELLER	88	AXIOM GP 100	265
D.B. MASTER UTILITY #1	69	ANADEX #9500	1290
THE TAX MANAGER	99	BROTHERS R/O PAR HRI	945
DATA PERFECT	75	NEC #8023	499
VERSA FORM	269	QKIDATA #84 SER.	1140
FILE MANAGER	75	SCN TP I	570
MAIL MERGE	169	XEROX 630	2145
D.B. MASTER UTILITY #2	70	IDS	$ CALL
THE GENERAL MANAGER	155	C. ITOH	$ CALL
WINDOW MAGIC II 40-80	99	PROWRITER	$ CALL
SPELLSTAR	160	*DISK DRIVES*	
PEACH PAK SERIES 4	327	RANA	$ 295
CHOPLIFTER	26	PERCOM (IBM)	299
GORF	30	PERCOM (ATARI)	390
FROGGER	26	AMDEK 3" DUAL (IBM)	725
MICROSOFT 256 RAM (PC)	580	CORVUS CORONA	$ CALL
MONITORS	$ CALL	MICRO SCI A35	315
MODEMS	$ CALL	QUME 2 DS 8	1495
TERMINALS	$ CALL	VISTA #1000 DS. DD	1795

M/C OR VISA ADD 5%. CALIF RESIDENCE ADD 6½%. SALES TAX. WE CREDIT YOU $1.00 WHEN YOU PLACE AN ORDER BY PHONE! CERTIFIED CHECK, CASHIERS CHECK OR P.O. MONEY ORDERS. PERSONAL CHECKS TAKE 3 WEEKS TO CLEAR. SHIPPING & HANDLING: SOFTWARE - ADD $4.50 - 1% OVER $150. HARDWARE IS COLLECT. SOFTWARE & HARDWARE TO AK, HI, PR, FOREIGN & AREAS NOT SERVICED BY U.P.S. IS ALSO COLLECT. C.O.D. ORDERS REQUIRE 20% DEPOSIT. PRICES SUBJECT TO CHANGE. WE ARE INTERNATIONAL SHIPPERS REGISTERED WITH THE U.S. DEPT OF COMMERCE. WE WILL MEET OR BEAT MANY ADVERTISED PRICES

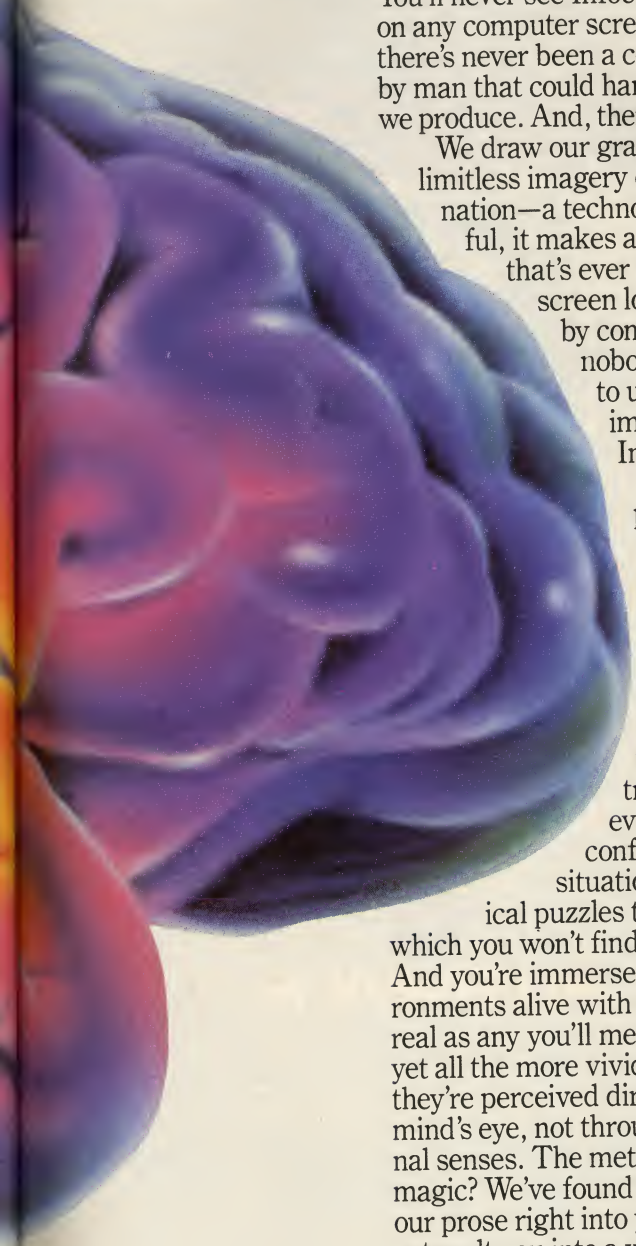
Dataware Inc.
1615 N. WILCOX AVE

MAIL ORDER'S TO:
DEPT "C" P.O. BOX 1122
HOLLYWOOD, CA 90028-1122
PHONE (213) 465-9751
DEALER INQUIRIES INVITED

CIRCLE 111 ON READER SERVICE CARD

WE UNLEASH TH
POWERFUL GRA

WORLD'S MOST
ICS TECHNOLOGY.



You'll never see Infocom's graphics on any computer screen. Because there's never been a computer built by man that could handle the images we produce. And, there never will be.

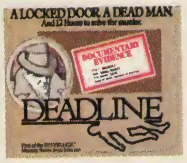
We draw our graphics from the limitless imagery of your imagination—a technology so powerful, it makes any picture that's ever come out of a screen look like graffiti by comparison. And nobody knows how to unleash your imagination like Infocom.

Through our prose, your imagination makes you part of our stories, in control of what you do and where you go—yet unable to predict or control the course of events. You're confronted with situations and logical puzzles the like of which you won't find elsewhere. And you're immersed in rich environments alive with personalities as real as any you'll meet in the flesh—yet all the more vivid because they're perceived directly by your mind's eye, not through your external senses. The method to this magic? We've found the way to plug our prose right into your psyche, and catapult you into a whole new dimension.

Take some tough critics' words about our words. SOFTALK, for example, called ZORK® III's prose "far more graphic than any depiction yet achieved by an adventure with graphics." And the NEW YORK TIMES saw fit to print that our DEADLINE™ is "an amazing feat of programming." Even a journal as video-oriented as ELECTRONIC GAMES found Infocom prose to be such an eye-opener, they named one of our games their Best Adventure of 1983.

Better still, bring an Infocom game home with you. Discover firsthand why thousands upon thousands of discriminating game players keep turning everything we write into instantaneous bestsellers.

Step up to Infocom. All words. No graffiti. The secret reaches of your mind are beckoning. A whole new dimension is in there waiting for you.



INFOCOM™

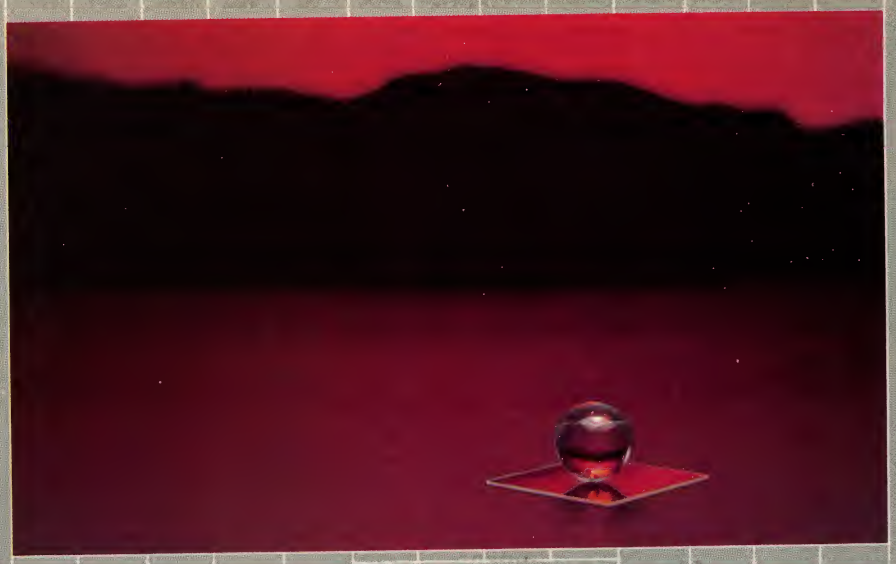
The next dimension.

Infocom, Inc., 55 Wheeler St., Cambridge, MA 02138

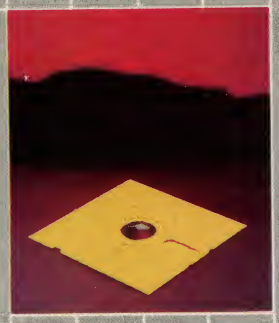
For your: Apple II, Atari, Commodore 64, CP/M 8", DEC Rainbow, DEC RT-11, IBM, NEC APC, NEC PC-8000, Osborne, TI Professional, TRS-80 Model I, TRS-80 Model III.

CIRCLE 115 ON READER SERVICE CARD

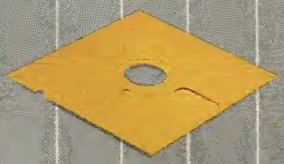
a.d. 2082. Diskettes duplicated by Allenbach in 1983 will still be guaranteed.



This Lifetime Guarantee, exclusive to Allenbach, adds quality and consumer confidence to your software products. While this alone is reason enough to let Allenbach handle your software duplication, most software developers initially choose us for convenience. We can probably complete your production faster than you can. Additionally, your whole project can become one-easy-step by having us perform all packaging requirements from printing to assembly.



You'll also appreciate the high standard of excellence demanded by Allenbach. Software duplication for practically any format is our primary business. We've established a team of professional technicians who specialize in all phases of software duplication. Your software is effectively reproduced on specially designed precision duplicating equipment. Also used are exacting verification methods unique in the industry to guarantee 100% accuracy. Plus your software will be duplicated onto the Allenbach diskette, the OEM diskette that is Guaranteed for Life.



ALLENBACH INDUSTRIES INC

Allenbach *really* is the logical solution for your software duplicating needs. So feel free to call us with your questions. Take advantage of our years of experience and knowledge. Have Allenbach do what we do best, so you can do what you do best.

2101 Las Palmas
Carlsbad, California 92008
619-438-2258
800-854-1515 (Toll Free)
Telex: 19-4561 LSA

CIRCLE 158 ON READER SERVICE CARD

Commodore: Price/Performance Leader

John J. Anderson

The News from Commodore

Commodore, which began years back as a business furniture and calculator company, was among the first manufacturers to offer an assembled microcomputer. It introduced the Commodore Pet in 1978. That machine remains in use in many homes and schools. It also served as a prototype for machines such as the Apple II.

When the 5K Vic-20 machine was first introduced in 1980, it was met with little enthusiasm. At $300 the machine was too cheap for the hobbyists and too expensive for the fledgling "mass market." So it languished for a while.

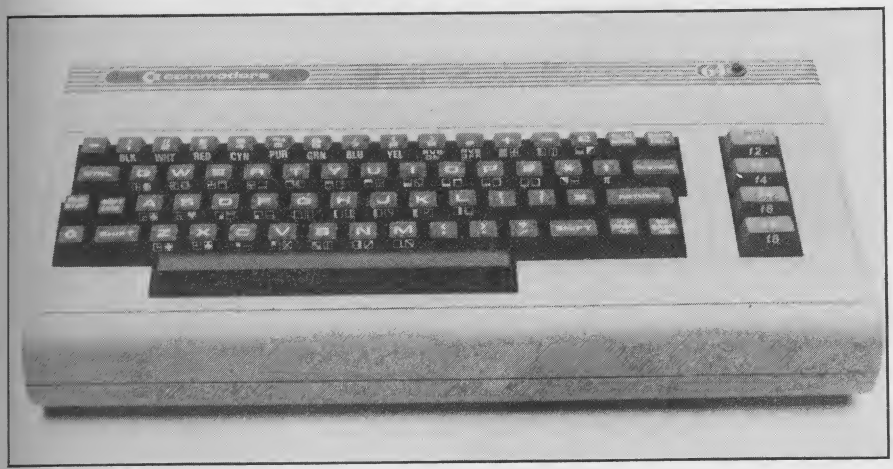
But Commodore kept on pushing the machine, and made price-cutting its basic strategy. By the time the mass market for microcomputers really began to materialize (Christmas of 1981), the Vic was selling for $200. It had some decent software, too, though mostly from third-party manufacturers. And so the race was on.

By Christmas of 1982, over a million Vic-20s had been sold, and they continue to be sold. Commodore claims that there are more Vics in use today than any other computer. Now selling for less than $100, the Vic has earned the title of "first true mass market computer."

Commodore has been poised to introduce its next generation Vic machine, originally called the Max, for quite some time now. But they know it would be foolish to release it anytime before the Vic has run its course. And that could be quite a while. For the Vic is still quite a good beginner's machine.

Commodore 64

In the meantime, the real news has been the Commodore 64. This machine comes with 64K standard, superlative color graphics and sound, and sprite animation capabilities. Its price story is even more impressive than that of the Vic. It began at a list price of $595, which led the pack for price/performance at the time of its introduction, about a year ago. Today you can walk into any K-Mart with an old calculator (as a trade-in) and walk out with a C-64 for $199. That is a *very* tough deal to beat.



The Commodore 64.

And what do you get for it? Well for starters, you get a 64K computer, the same as the IBM or Apple IIe minimum configurations. Basic is built in to the machine, and CP/M capability is on deck for future release, along with Pascal, Logo, and Forth. The Commodore 1541 disk drive is among the least expensive drives available for any machine. A complete system with drive and display can be put together for under $1000.

Add to this sophisticated sound and graphics, and the dozens of quality software packages now becoming available. You will realize that the 64 is a force to be reckoned with.

At the recent Consumer Electronics Show two interesting musical peripherals for the 64 were shown: a piano keyboard and a drum synthesizer unit. They will debut soon for under $100 each and bring the formidable musical potential of the 64 within the grasp of the average non-technical user.

And wait until you hear the speech synthesis module for the 64. It speaks for itself, of course.

Another bit of hardware news is that Commodore has just introduced a CRT-portable version of the 64 unit, which it is calling the Executive 64 (see photo). In addition to all of the features of the standard C-64, this machine has a detachable keyboard (ā la IBM), built-in 6" color monitor, and a built-in disk drive with 170K capacity. A second, optional drive will also fit the 5" x 14-1/2" x 14-1/2" case. The unit weighs in at 27-1/2 lbs.

Commodore has also shown an NTSC monitor under its own label, which will be quite inexpensive (under $300), and will display the best picture the 64 is capable of putting out.

Up until quite recently Commodore has been classified as a hardware-driven company, but that might be changing, dramatically and soon. The company has finally announced a very real commitment

The Executive 64.

to software development, and is backing up the rhetoric with lots of actual packages. Among the programs it has announced for the 64 are *EasyScript*, a $50 word processor, *EasyCalc*, a spreadsheet program, and *Magic Desk*, an expandable system master program that uses a format of nested pointers and icons similar to that of the $10,000 Apple Lisa machine.

Dozens of other games and application programs will shortly be offered by Commodore, including packages from third-party vendors. Among these are *Multi-Plan* an extremely powerful and friendly spreadsheet package developed by Microsoft, and the entire series of state-of-the-art text adventures from Infocom, including the *Zork* series and *Starcross*.

Nearly as impressive as the array of software to be offered are the prices at which they will be offered: Commodore intends to make its software packages the most competitive in the marketplace. None of its packages will sell for over $100.

With this aggressive strategy and a good bead on the future, Commodore will assuredly remain a very tough competitor in the microcomputer industry for years to come. And rest assured, hardware prices will continue to drop. It wouldn't surprise me if the 64 were selling for under $100 by Christmas... □

The Vic 20

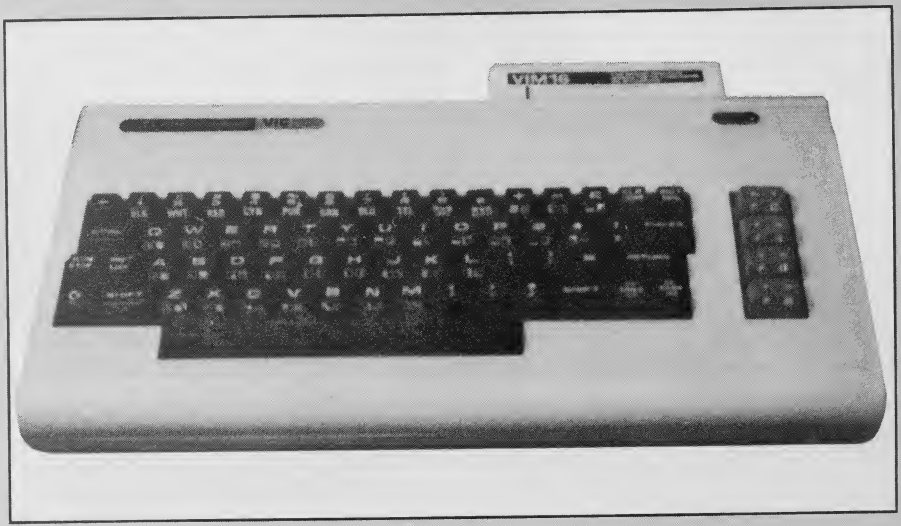
With all the curent brouhaha concerning the Commodore 64, it is easy to forget its initial incarnation, the Vic 20. Now available for as little as $80, the Vic continues to sell.

This is a machine with a unique claim to fame: it has sold over a million machines. It will be a little while before even IBM can make that claim for its PC.

Though the Vic is much less powerful than its big brother, the 64, it can do quite a lot. It is the least expensive micro on the market today with a full-stroke typewriter-style keyboard, including four programmable function keys. It has color graphics and sound capability, to handle fast action arcade games using a standard Atari joystick. It has a version of the Basic language built-in.

With 5K standard, you will quickly want to expand the RAM memory of the Vic. At 16K, you can run nearly every Vic program on the market today. And with the basic unit discounted to as low as $70 in some places, the extra memory is not a big additional expense.

The Vic remains a popular and viable choice in the low-end of the home computer scale. Don't be surprised at a $50 price for it soon! —*JJA* □



The Vic-20.

600 XL .. $199.00
800 XL... $CALL$
1200 XL. $499.00
1400 XL . $CALL$
1450 XL . $CALL$
1025 Printer $399.00
1020 Color Printer . $245.00
1027 Printer $299.00

EASTERN HOUSE
Monkey Wrench 2 .....$52.75
PARKER BROTHERS
Tutankham R.....$33.75
Super Cobra R $33.75
Astro Chase R.....$33.75
Frogger R $33.75
QBert R $33.75
Popeye R.....$33.75
Risk R $42.75
Chess R $42.75

800 48K $199.00*

* after $100. rebate from ATARI cash price $299.

810 Disk $399.00

MODEMS

ANCHOR MARK I ..$79.00
ANCHOR MARK II..$79.00
HAYES SMART ...$239.00
HAYES MICRO II $309.00
Micro Bit
MPP-1000.....$159.00
NOVATION
CAT $144.00
D-CAT.....$155.00
J-CAT $115.00
APPLE CAT II $279.00
212 APPLE CAT . $589.00
BRODERBUND
Bank Street Writer D.....$44.75
AE D.....$24.75
Apple Panic D.....$23.75
Choplifter ROM $32.75

RANA DISK DRIVE

1000 .....$call

ALIEN GROUP
Voice Box 2 . $99.75
DON'T ASK
Sam $41.75
Abuse $15.95
Teleatrl.....$27.95
Poker Sam ..$24.95

ATARI®
Computers for people.™
© 1981 ATARI INC

1010 Recorder.....$75.00
410 Recorder $75.00
810 Disk Drive.....$399.00
1050 Disk Drive $335.00
850 Interface.....$CALL$

Lyco Computer Marketing & Consultants

TO ORDER CALL US

TOLL FREE 800-233-8760
In PA 1-717-

BLANK DISK

ELEPHANT SS/SD.... $18.25
ELEPHANT SS/DD.... $21.75
KANGAROO SS/DD with storage case $24.75
MAXELL MD I $29.75
MAXELL MD II $39.75
DISK CASE (holds 10) $4.95
DISK CASE (holds 50) $19.75
ROM CASE (holds 10) $19.75

MONITORS

Amdek Color I $275.00
Amdek 300 Green $149.00
Amdek 300 Amber $149.00
Gorilla Green $99.00

PERCOM

SINGLE DRIVE AT88 S1 ...$359.00
DUAL DRIVE AT88 S2 .....$559.00
DRIVE with printer port ...$449.00
AT88 Expansion Board $139.00
DUAL HEAD 44S1 .....$575.00
SINGLE DRIVE 40S1 .....$529.00
ADD ON DRIVES .....$CALL
HARD DISK DRIVES $CALL$

RANA DISK DRIVES

Elite 1..... $295.00
Elite 2..... $449.00
Elite 3..... $559.00
SSI
Battle of Shilo $26.75
Tigers in the Snow.... $26.75
Cosmic Balance $26.75
Knights of the Desert. $26.75
Battle for Normandy.. $26.75
Germany 1985 ..... $36.75
CONTINENTAL
Home Accountant $51.75
Book of Apple Software . $16.75

apple®
Apple is a Registered Trademark of Apple Computer, Inc.

APPLE DUMPLING GX $99.75
APPLE DUMPLING 64...(16 Buffer)$179.75
INFOCOM
Zork I, II, or III..... $26.75
Deadline $33.75

CARDCO

Cardprinter / LQ1.....$499.00
Cardprint DM1.....$109.00
5 Slot Expansion 64 .....$54.00
64 Write NOW.....$39.00
64 Mail NOW.....$29.00
20 Write NOW.....$29.00
64 Keypad $29.00
Universal Cass. Int.....$29.75
Printer Utility.....$19.75
6 Slot Expansion.....$79.95
3 Slot Expansion.....$24.95
Vic 20/64 Printer int.....$59.95
SPINNAKER 64
Kindercomp.....$21.75
Story Machine $23.75
Face Maker $23.75
Snooper Trooper.....$29.75
Delta Drawing.....$34.75

commodore

HES VIC-20
Torg C.....$14.75
HES Games I C $14.75
HES Games II C $14.75
VIC Fortit Rom.....$42.75
HES MON Rom $28.75
Turtle Graphics Rom $28.75
HES Writer Rom $28.75
Shamus Rom.....$28.75
Protector Rom $31.75
Robot Panic Rom $28.75
BRODERBUND 64
Serpentine R..... $26.75
Choplifter R..... $32.75
Seafox R $26.75
PARKER 20
Frogger (ROM).....$33.75
QBert (ROM) $33.75
Tutankham (rom) $33.75

SANYO

MBC 1000.....$1549.00
(with micropro software package)
MBC 1250.....$2195.00
MBC4050 .....$2749.00
EFD 160 Disk.....$499.00
5500 Letter Q. Printer...$649.00

HES 64

Turtle Graphics R $49.75
Heswriter R $38.75
Attack of Mut Cam R...$34.75
Turtle Tutor R $29.75
Turtle Trainer R $29.75
Paint Brush R $23.75
Benji Space Rescue D.$29.75
Home Manager C/D ...$39.75

PRINTER RIBBONS AVAILABLE

PROWRITER 2P.....$699.00
GEMINI 15.....$449.00
PRINTMASTER....$1589.00
SMITH CORONA TP1...$549.00
CITOH 8600B.....$1025.00
STARWRITER.....$1099.00
OKIDATA 82 ..... SAVE
OKIDATA 83 ..... LOWEST PRICE
OKIDATA 84P.... AVAILABLE
OKIDATA 93 ..... SAVE
TRACTOR..... $49.75
OKIDATA 92..... $SAVE

SAVE on these in-stock PRINTERS

GORILLA GX-100 .....$199.00
EPSON ..... $CALL
GEMINI 10 ..... $299.00
PROWRITER..... $365.00
NEC 8023 .....$399.00

MasterCard VISA

TO ORDER

CALL TOLL FREE
800-233-8760
In PA 1-717-327-1824

or send order to
Lyco Computer
P.O. Box 5088
Jersey Shore, PA 17740

POLICY

In-stock items shipped within 24 hours of order. Personal checks require four weeks clearance before shipping. No deposit on C.O.D. orders. Free shipping on prepaid cash orders within the continental U.S. PA residents add sales tax. All products subject to availability and price change. Advertised prices show 4% discount offered for cash, add 4% for Master Card or Visa. DEALER INQUIRIES INVITED.

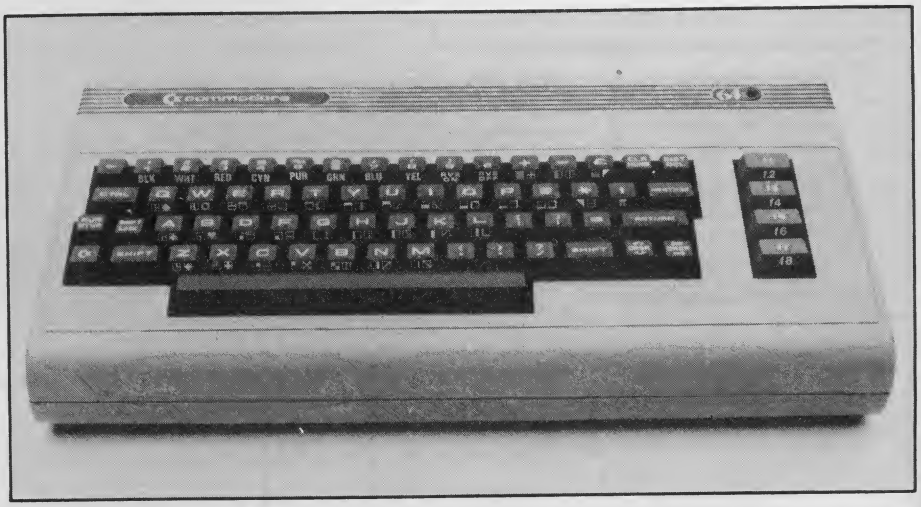
CIRCLE 117 ON READER SERVICE CARD

Commodore 64

The Commodore-64 is a lot of computer for the money. It comes with 64K of RAM memory, excellent graphics, a three-voice sound synthesizer, Microsoft Basic, a 6510 microprocessor, a built-in RF modulator to connect with a television, and a typewriter-style keyboard. It has now been discounted to under $300.

Although not a true "open design" such as the Apple II or IBM PC, the 64 has several easy-to-use input/output interfaces built in. There is even a cartridge slot that will allow a Z80 microprocessor or game cartridge to be added to the system.

Commodore has announced that the popular CP/M operating system will be available when the Z80 cartridge is released in late 1983. A single 5 1/4" floppy disk (Model 1541) is available for an additional $399.



Ron Jeffries

Not A 40-Column Vic

The 64 is packaged in a plastic case that looks exactly like the Vic-20, except that it is brown instead of white. But don't let that fool you: the 64 is *not* a 40-column Vic. The two computers share only two features: the plastic case, and the same version of Pet Basic.

Vic programs that don't use any of the special Vic graphics or sound and that do not rely on the 22-column screen will run on the 64. Unfortunately, those constraints severely limit the number of Vic programs that will work on the 64.

The 64 uses a 6510 microprocessor. The 6510 is exactly like a 6502 (which is used by the Pet, Vic, Apple, and Atari) except that the first two bytes of page zero have been "stolen." These two memory locations are used for an on-chip 8-bit input/output port by the 6510. The 64 uses this port to control its memory map, which makes it unusually flexible.

R. K. Jeffries, 5266 Hollister, Suite 224, Santa Barbara, CA 93111.

Excellent Keyboard

The first thing that impressed me when I unpacked the 64 was the excellent keyboard. Several people who have wandered by my office have tried the keyboard, and their comments have all been quite positive.

As is true of most computer keyboards, some keys are not placed where they would be on a standard typewriter. If you are a touch typist, be sure to type for a few minutes on the 64 keyboard before you decide to buy it. The placement of keys on the 64 probably won't bother you.

The keyboard of the 64 is sculptured, which means that the tops of the keys are slightly concave when viewed from the end of the keyboard. (Some keyboards look like a staircase when viewed from that angle.) Most typists seem to prefer the sculptured design, which is what IBM uses for their popular Selectric typewriter.

The 64 keys also have a matte, non-glare surface that is attractive. The "feel" of the keyboard is above average, although for my taste it is a little softer than ideal. There is no audible click when a key is pressed, a feature I have come to appreciate on machines such as the Atari 800.

As a point of reference, the IBM Selectric keyboard is the best I have ever used. My favorite personal computer keyboard is the IBM PC. It has a sharp, "clicky" feel that works very well for me. I rate the 64 keyboard about 7 on a scale of 1 to 10, with the IBM PC rating a 9, and the Selectric getting a perfect 10. Obviously, the 64 does very well in comparison with the much more expensive IBM PC.

The 64 keyboard has a somewhat high profile. The home row of keys is 70mm above the desk surface. (The 64 looks higher that it is. For example, the fairly sleek Atari 800 has a 77mm high home row.) A low profile keyboard such as the IBM PC places the home row of keys approximately 30mm above the desk top. Research in human factors has shown that low profile keyboard design reduces fatigue in users' fingers and hands.

HARMONY VIDEO & COMPUTERS
800-221-8927

COMMODORE	
VIC 20	79.95
COMMODORE 64	209.95
VIC 2N DATASETTE	59.95
COMMODORE DISC DRIVE	209.95
1525B PRINTER	209.95
COMMODORE MONITOR	219.95
VIC TELEPHONE MODEM	89.95
RS 232 TERMINAL INTERFACE	CALL
IGEE-488 INTERFACE	CALL
VIC 8K MEMORY PAC	39.95
VIC 16K MEMORY PAC	89.95
MOTHER BOARD	89.95
VIC 3K SUPER EXPANDER	
VIC PROGRAMMER'S AID	CALL
VIC MON	CALL
INTRO TO BASIC I & II	69.95

APPLE 2 PLUS
999.95

APPLE 2E
CALL

EPSON
MX 80 PRINTER
399.95

EPSON
FX 80 PRINTER
599.95

ATARI	
ATARI 400 W16K	79.95
ATARI 800 W48K	269.95
ATARI 1200 XL W64K	369.95
ATARI 410 RECORDER	76.95
ATARI 1010 RECORDER	77.95
ATARI 810 DISC DRIVE	389.95
ATARI 830 ACOUSTIC TEL. MODEM	159.95
ATARI 850 INTERFACE	169.95
ATARI 822 THERMOL PRINTER	CALL
ATARI 1020 40 COL. PRINTER	219.95
ATARI 1025 80 COL. PRINTER	379.95
ATARI 16K MEMORY EXPANDER	89.95
ATARI WORD PROCESSOR	69.95
ATARI BASIC REF. GUIDE	CALL
ATARI PROGRAMMER KIT	CALL
ATARI ENTERTAINER KIT	29.95

WE CARRY A FULL LINE OF SOFTWARE FOR ATARI AND COMMODORE
CALL FOR LOWEST PRICES

ALL SONY T.V.'s IN STOCK CALL FOR LOWEST PRICES

ALL VCR's IN STOCK CALL FOR LOWEST PRICES

VIDEO TAPE (By case of 10 only)

	VHS T120	VHS T160	HIGH GRADE	BETA L500	BETA L750	BETA L830
TDK	8.45	14.75	10.75	6.50	7.99	10.25
FUJI	9.65	14.75	11.75	6.50	7.99	
MAXELL	8.40	13.50	10.25	6.50	7.99	10.25
MEMOREX	8.75	13.50	10.50	6.50	7.99	10.25
SCOTCH	8.50	13.50	10.25	6.50	7.99	
SONY			10.25	6.99	8.10	10.25
JVC	8.85	13.50	11.50			
RCA	8.55					
PANASONIC	7.90					

TDK PROFESSIONAL T120 15.95
MAXELL PROFESSIONAL L750 OR T120 15.95
MEMOREX PROFESSIONAL 16.95

FOR THE LOWEST PRICES ON VIDEO CALL 800-221-8927

To order simply dial toll free 800-221-8927 with your Master Card or VISA and your order will arrive via UPS or send certified check or money order only to: HARMONY VIDEO AND ELECTRONICS, 2357 Coney Island Ave., Brooklyn, N.Y. 11223, and add approximate shipping postage and insurance charges. Credit cards for phone order only. For customer service please dial (212) 627-8960. All pries and availability subject to change without notice. All orders shipped out of state. Dealer inquires invited!!! For sales info dial (212) 627-6989. Open Sun. 10-4 Mon.-Thur. 9-7 Fri. 9-3.

800-221-8927

COMMODORE ATARI APPLE TEXAS INSTRUMENTS EPSON

For video and computer Catalog mail $3.00 for postage and handling to the above address.

JVC • PANASONIC • SONY PROFEEL • ZENITH • HITACHI • QUASAR

G.E. • SANYO • SONY PROJECTION • TDK • MAXELL • FUJI • SCOTCH • SONY • RCA

CIRCLE 113 ON READER SERVICE CARD

Commodore decided to use a slightly modified Vic plastic case for the 64, even though that meant having a high profile keyboard. On the other hand, by using existing plastic tooling, they were able to get the 64 to market several months sooner than if they had designed a new case. (They probably also saved $20,000 to $50,000 in development costs.)

Advanced Graphics

The graphics capabilities of the 64 are exciting. Commodore-64 graphics are more powerful than those of the Atari, IBM PC, Apple, TI 99/4A, or Radio Shack Color Computer. (The 64 also has far stronger graphics than its cheaper cousin, the Vic-20.)

The most important feature is its dedicated hardware support for rapidly displaying eight detailed objects anywhere on the screen. Each of these objects (Commodore calls them *sprites*) can be 24 pixels wide and 21 pixels high, or about the same as a block of 3 x 3 characters.

After a sprite is designed, and the dot-by-dot pattern for the display (called a *bit map*) is stored somewhere in memory, the sprite can be moved around on the screen very quickly and easily. All the programmer has to do is POKE the horizontal and vertical location into the appropriate registers of the dedicated graphics procesor called the "Video Interface Chip," or VIC. The VIC chip directly supports eight sprites at one time. (In machine language it is possible to "re-use" sprites, and thus have more than eight of them on the screen at once.)

Sprites Are Versatile

Each sprite has a priority. This allows one sprite to appear to pass in front of another sprite, so that three-dimensional effects are possible. The video chip also keeps track of collisions between sprites, and between sprites and the foreground. This can be very useful when writing sophisticated game programs.

Each sprite can be enlarged to be twice as wide, or twice as tall, or both. However, when a sprite is enlarged, there is effectively half as much resolution, since the same bitmap of 24 by 21 pixels is used. (The pixels making up the sprite are enlarged.)

Likewise, a sprite can use four colors (instead of the normal "on" or "off") at the expense of having half as much resolution.

Until you can see an example program that uses sprites, it is hard to understand what a powerful tool they are. Machines like the Apple that do not support sprites face tough competition from those like Commodore, Atari, and Texas Instruments that do provide this facility.

Music Synthesizer

The 64 produces sound using the 6581 Sound Interface Device (SID). This special chip is a music synthesizer and sound effects generator. It provides three voices that can be controlled by the user.

For each voice, you can control pitch over a nine-octave range. The waveform can be a triangle wave, sawtooth, variable pulse, or noise. (You can create great sound effects for games with the noise waveform. For example, it is easy to produce explosions, shuffling feet, or ocean waves.) For each voice, you can also control volume, and there is a master volume control.

For each of the three voices, you can control what are called *envelope generators*. The way a note or sound effect sounds when it is produced is the result of many different things. Naming the envelope of a given sound is a shorthand way of describing four of the important parameters that control how it sounds.

There are four parameters that describe an envelope: attack, decay, sustain, and release, or ADSR for short. With the 64, the attack rate can be varied from two milliseconds to eight seconds. Both the decay and release rate can range from six milliseconds to 24 seconds, and the sustain level can range from zero to peak volume.

After spending quite a bit of time using a *sound editor* that makes it easy to build new sounds and then experiment with changing them, I am very impressed with what the SID can do. Frankly, I can't remember the last time that I have had this much fun (at least with a computer). When I start playing with 64 sound generation there just doesn't seem to be a good place to stop. Many 64s will be purchased solely because of the SID synthesizer.

Given the excellent sound and graphics capabilities of the 64, it is too bad that Commodore did not choose to support the new hardware at a high level in Basic. All of the sound and graphics are controlled with POKE statements that change magic memory locations. POKEs are inconvenient for experienced programmers, and completely mystifying to novice users. Fortunately, Commodore has announced a graphics and sound cartridge for release soon. It will provide graphics and sound commands.

The 1541 Disk Drive

In addition to supporting the standard Commodore cassette tape format for storing programs and data, the 64 can also be used with the Vic-1541 disk drive.

The 1541 uses a 5¼" drive that stores approximately 170,000 bytes. The drive is a single-sided unit that uses Commodore's unique disk format, and is packaged attractively.

The disk format used by the 1541 is compatible with the standard Commodore 4040 disk drives that have been used for several years with the Pet and CBM models. This means that disks can be transferred among the 64, the Pet, and the Vic-20.

In the case of data files, no changes should be needed when interchanging files. Pet programs can be transferred to the 64 easily. Many Pet programs work on the 64 after minimal editing. Programs that POKE screen locations must be changed, since the screen has moved.

Changing the CB2 sound of the Pet to use the SID chip isn't difficult, if you use this formula:

```
10 HS = 2 ↑ (1/12)
20 SID = INT(.5 + 14*HS
     (LOG(255/CB2)/LOG(HS)))
```

Where SID is the value to POKE into location 54273, and CB2 is the value that was POKEd into location 59464 on the Pet. Naturally, you have to have the other SID parameters set up correctly for the 64 sound to work.

Commodore plans to release what

How to Transfer C64 Programs to the PET

Taking 64 Basic programs to the Pet is somewhat complicated. After LOADing the 64 program into the Pet from disk or cassette, use the PET monitor as follows:

SYS 1024

At this point, the monitor will display the contents of the 6502 registers. We can ignore them, and type the M command to display a portion of the PET memory:

.M 0400 0407

The command shows the contents of the seven bytes that begin at location 0400 hex. We will ignore the values that it displays, and type the following in their place:

.: 0400 00 01 08 00 00 00 00 00

After pressing RETURN, exit from the monitor with the "X" command:

.X

Now, in Basic, type a zero and press RETURN. What we have done is play a trick, using the machine language monitor. We created a fake line zero in the monitor, and then deleted it in Basic. If your program already has a line zero, it will not be deleted, since Basic will only delete the first line zero that it encounters, which will be our fake line.

they call a Pet emulator for the 64, that will do much of the dirty work for you. I think that converting a Pet program to the 64 is a better approach, since there is no runtime overhead, and you can take advantage of unique 64 features such as color, user-programmable characters, sprites, and of course multiple-voice sound.

"Smart Peripheral" Problems

The disk operating system for the 1541 resides in ROMs that are in the 1541, rather that in the 64. The advantage of this approach is that the DOS doesn't consume any RAM in the computer, since it has its own RAM on the disk controller.

Commodore takes great pride in the fact that their system has what they call "smart" peripherals. What this means is that each disk unit or printer has its own microprocessor, and can accept commands from the "main"computer, such as the 64.

Unfortunately, there is a fly in this intelligent peripheral ointment. Basically, the disk is a very independent device. The 64 sends it a command, the disk attempts to perform the requested action, and then sets an error code. Note that I said "sets an error code," not "tells the computer whether things worked or not."

The problem with the Commodore aproach is that the user program (or the user, in the case of commands from the keyboard) is responsible for discovering that an error has occured. When something doesn't work, the 64 does not print an error message on the screen.

The result of all this is that Commodore disk systems such as the 1541 are not among the easiest to use when compared with other personal computer systems. Evidently, there are many consumers who either don't know the difference, or don't care, because Commodore disk systems seem to sell very well.

Limited Disk Speed

The 1541 disk transfers data slower than several other personal computer disk systems. For a simple benchmark, I used a program that writes 10,000 bytes to the disk. (To keep the interpretive overhead down, the program uses a FOR loop that goes from 1 to 500. Each time through the loop a string of 20 bytes is written to the disk.) The 64 with the 1541 disk took 34.8 seconds to write 10,000 bytes. The standard Pet 4040 took 17.5 seconds, and the Atari 800 took 28 seconds with "read-after-write" disabled.

Atari is the only personal computer that automatically reads each sector after it is written. However, this Atari "feature" can be disabled by typing POKE 1913,80. With read-after-write *enabled*, the Atari 810 disk took 46 seconds for the benchmark. The IBM PC with IBM DOS took 11.4 seconds to write the 10,000 bytes.

I ran each disk test several times and averaged the results. Also, the old data file was scratched by using a keyboard command rather than in the benchmark program. To my surprise, I found that scratching a file from the disk takes quite a while.

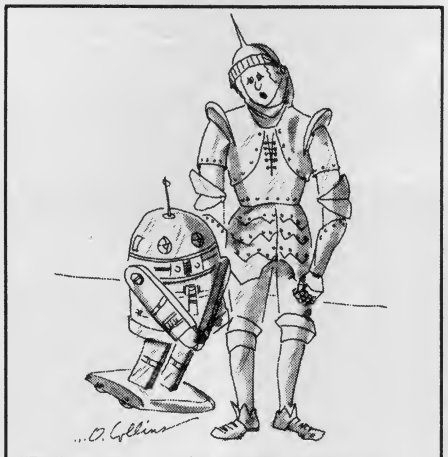
Furthermore, the amount of time taken to scratch a file depends on the location of a file on the disk in several popular disk operating systems. For example, with the 1541 disk, a scratch command can take a noticeable amount of time.

Since most consumers don't bother to time the performance of their disk drives, the important question about the 1541 may be "Is it fast enough for the average user?" The answer is a qualified "yes." If you mainly use the disk for program storage, *any* disk is much faster than a cassette tape recorder. But if you plan to use the 64 for disk-intensive data management, you should do some serious benchmarking before making a purchase decision. At $399, the 1541 is one of the least expensive disk units available for personal computers.

Conclusions

The Commodore-64 is an excellent value. For under $300 you get powerful graphics, a complete sound synthesizer, and a versatile computer with 64K of memory. At the moment, I think it is the "best buy" in its price range. Now if you'll excuse me, I need to get back and tune-up my 64 snare drum sound effect...

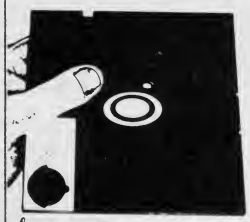
Acknowledgements: Glen Fisher of The Code Works provided numerous clarifications of the technical details of the 64. David Rosenwald of Commodore was most helpful in providing hardware and software. □



"Believe me—you're making a big mistake."

***DOUBLES DISKETTE STORAGE SPACE!!**

REDUCE YOUR DISKETTE COSTS BY 50%



*The back of your 5¼" single sided diskette has recording medium. All you need is an ACCURATELY placed ***"write enable notch"*** to USE IT, on many systems. ***NIBBLE NOTCH***™ is a precision engineered tool designed for this purpose.

IT'S A MONEY SAVER!
IT'S A TIME SAVER!

$14.95

Add $1.50 Postage/Handling ($4.50 Foreign)
— Florida Residents Add 5% Sales Tax —

ORDER TODAY!
SEND CHECK OR MONEY ORDER TO:

NIBBLE NOTCH ™
Division of Cortran International
4211 N.W. 75th Terrace, Dept. 7 9
Lauderhill, Florida 33319

PAT. PEND.

CIRCLE 121 ON READER SERVICE CARD

MAGIC "INPUT/OUTPUT" MUG

Let the world know when you're on a coffee break. When hot liquid is poured in, one message disappears and another takes its place on the computer screen. Fascinating to watch. Big 10 oz. size. Fine quality white English porcelain. 10 day money-back guarantee if not completely satisfied. $8.95

Call Toll-Free Mon.-Fri. 9am-6 pm
1-800-B-E-S-W-E-E-T
exc. Fla. or mail coupon.

sweet gum inc. BG093
15490 NW 7th Ave., N. Miami, FL 33169
Please send me the Magic "Input/Output" Mug.
Quant. ___ @ $8.95 Add $2 each for shipping & hand.
Fla. residents add 5% sales tax. Total $_____
Encl. is Check ☐ MO ☐ Charge my MasterCard ☐
Visa ☐ Credit Card #_____
Exp. Date _____
★☐ Just send me your free COMPUTERMANIA Catalog for now. ★
Signature _____
Name _____
Address _____
City _____
State _____ Zip _____

CIRCLE 133 ON READER SERVICE CARD

What's Coming From Atari

John J. Anderson

A Tale Of Atari

Once upon a time, way back in the dim reaches of 1978, a quite inspired and rather wild group of young hard-partying hardware people did a pretty amazing thing: they decided to design a couple of microcomputers that were years and years ahead of their time.

They might have compromised themselves to shortsighted marketing representatives or caved in to pressuring cost-cutters. But they didn't, you see, because these fellows worked for Atari, which was a young, spry, and idealistic company that had no conventional corporate limits to its imagination.

In the field of computers for average consumers, which it in fact created, Atari then knew no boundaries.

And so the Atari 400 and 800 machines were born. They had for their inspiration the ubiquitous Apple II, a computer that some of us still idolize today. And the Atari machines were designed to do much more, with much less effort.

Today the 800 remains among the most powerful and flexible microcomputers around. Its graphics and sound capabilities still dance rings around competitors costing four times as much. It and its little brother the 400 have developed a fiercely loyal following. They have constituted the prototypes for the next-generation machines of competitors.

Why, then, you may ask, haven't these machines grown to be an unbeatable force in the microcomputer market?

Well, somewhere along the way, and understandably due to the pressures of its unprecedented growth, Atari underwent what some psychologists might label "severe mood swings." It seemed as if they had somehow lost their identity. They changed their minds, their organizational structures, their personnel, their physical plant, and most significantly their basic philosophy, on very nearly a daily basis.

They seemed to have trouble deciding whether they really wanted to be in the microcomputer business at all. The name Atari has, after all, since its inception been synonymous with games. People remain hard pressed to associate the name with anything else. For a very long time it was almost a secret that Atari made anything other than video games.

And Atari itself did precious little to assert otherwise.

Luckily, third-party forces interceded to change this. They recognized in Atari computers the potential to do anything that the so-called "serious" machines could do, and much more. And they began writing programs to prove the thesis.

Atari, in the throes of its growing pains, for a time gave the educated user and the third-party developer as little cooperation as possible. It seemed as if they would go out of their way to make things hard for these people. Many experimenters got fed up and moved on to other machines.

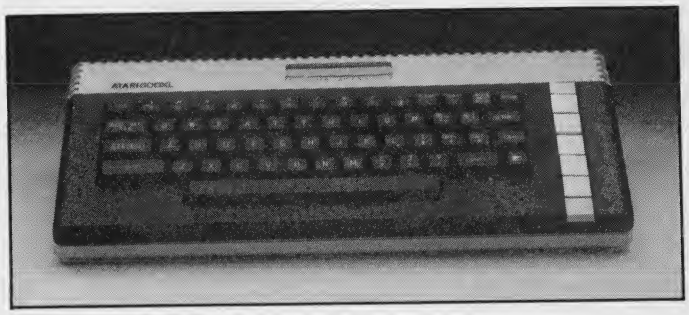
Atari had developed, you see, along the way what in Greek tragedy is called the "fatal flaw." In their success, they had managed to forget somewhere in the cardboard boxes at Borregas Avenue from whence their main strength emanates.

It does not emanate from marketing representatives or corporate cost-cutters. These types were responsible for the debacle which was the Atari 1200. This model constituted an object lesson in how not to design and build a microcomputer. Though it can still be found on some stockroom shelves, it can accurately be called the Edsel of micros.

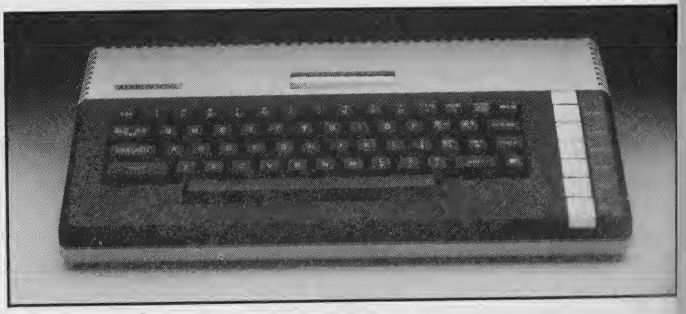
The main strength of Atari emanates from its loyal and informed users. These are the people who, individually, through users groups, or on behalf of their companies threw out such a hue and cry that the Atari 1200 was finally left for dead.

And in having the courage to admit its error and choose a new lineup, Atari has shown some class, and the first signs of intelligent life we've seen in some time. Let's hope they keep it up.

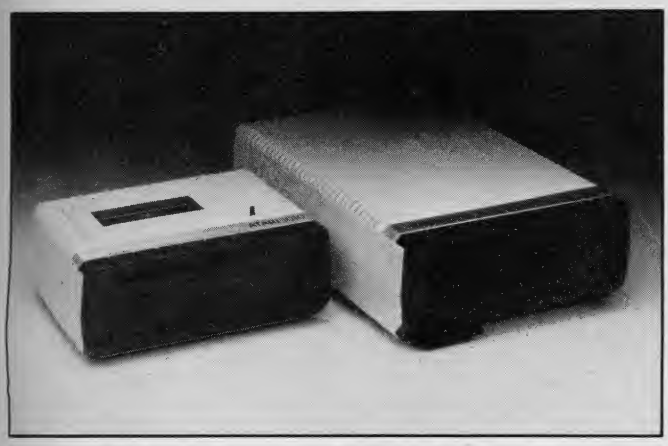
For after a rather humorous, albeit bizarre, detour, Atari home computers are moving in the right direction once again. That is, moving ahead, especially in terms of competitive pricing, while wisely leaving some proven formulas untampered with. Bravo, boys. Atari has even gone so far as to rejoin its consumer electronics and computer divisions. Per-



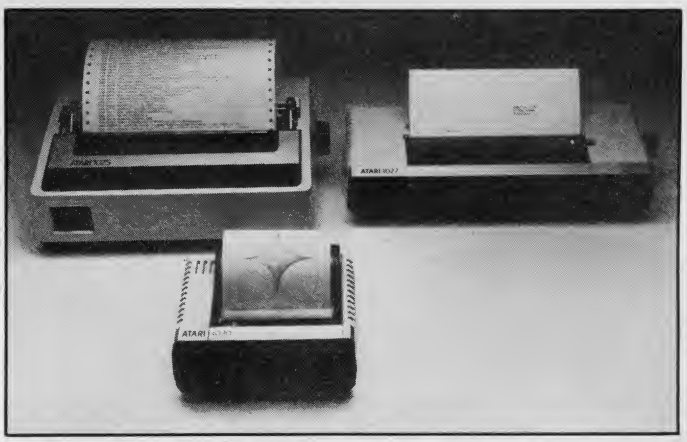
Atari 600 XL.



Atari 800 XL.



Atari 1010 Program Recorder, and 1050 disk drive.



The 1025 is a dot matrix printer. The 1027 is a letter quality printer. The 1020 is a four-color plotter.

haps now these groups can stop undercutting each other and concentrate on undercutting the competition.

New Atari Products

Here is the roster of new products, all promised for delivery in the fourth quarter of 1983:

• *The Atari 600 XL.* With 16K expandable to 64K, a full-stroke keyboard, and built-in Atari Basic, the machine has a promising future. Especially so in light of the fact that it will employ the original operating system that made its predecessors famous—that means it will boot *all* existing Atari software within existing memory constraints. It lists for $200.

• *The Atari 800 XL.* This machine will have 64K standard, and also use the old OS, as do all the new machines from Atari. And, using its expansion port, memory can be expanded to a whopping 192K. And jumping jiminy, the list price is only $300.

• *The Atari 1400 XL.* This is the replacement machine for the ill-fated 1200, with most of the serious grievances redressed. The compatible operating system will be there, along with hardware expansion capability, and even (hold on to your hats) a built-in modem! It may sound as if I am making this up, but it is the truth; there will even be an onboard speech synthesis chip. Jeepers. For a list price of $500, I would have settled for a measly parallel port.

• *The Atari 1450 XLD.* Not much more than a 1400 XL for your $800 list, except for the built-in low-profile 5-1/4" disk drive. Atari Home Computer Division, you may have been down, but you are not out of the game yet. Not by a long shot. Okay, it is quite conceivably the bottom of the ninth, with two out. But Casey is on base, one might propound on the basis of this news, and the tying run is at the plate.

• *The Atari 1050 Disk Drive.* This is the new stand-alone half-height drive. Using the new DOS 3.0, it is capable of over 125K of storage on a single disk. At the same time, it remains completely compatible with all existing 2.0 disk software. The door mechanism on the drive has been improved and now features a latch-type closure. The list price for the unit is $450.

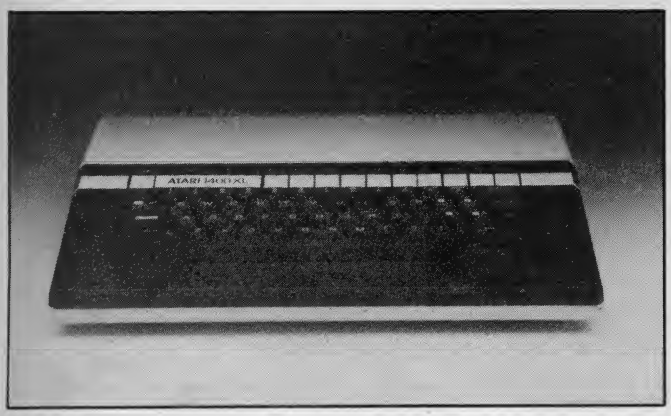
• *The Atari 1027 Printer.* An 80-column letter-quality printer for $350? There must be some mistake. But no, that is the list price of the 1027, which plugs directly into any Atari, and provides fully formed characters at 20 cps. At 15" x 6-1/2" x 3", the printer takes up hardly more space than a disk drive. It is quiet, and though I have heard complaints of registration problems with barrel printheads, the samples I created with the Atari 1027 looked absolutely perfect.

• *The Atari CP/M Module.* The Atari is a game machine, right? Well, it is true that the Atari plays better games than any other micro or video game. But it has always done more. And now, with CP/M, it becomes a 64K Z80 machine, capable of running at 4 MHz. What does that mean to you? It means access to heavyweight word processing, databases, speadsheets, and business software.

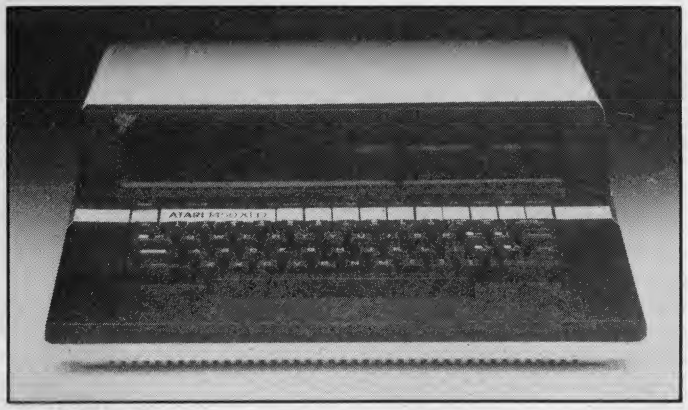
With a display switchable to 80 columns, the CP/M module makes any Atari into just about the most serious machine you could imagine. Not priced at press time.

• *The Atari Expansion Box.* When the Apple II was introduced, it had eight slots in the top of its motherboard for add-on hardware. This was a part of what made that machine so popular. Now an expansion chassis will make eight slots available to the Atari machine, along with two RS-232 serial ports and a bidirectional parallel bus. Huzzah huzzah, now special peripherals and custom hardware cards can play a part in the future of the Atari. Not priced at press time.

Way to go, Atari. What a comeback. We can't wait to see what is next from you! □



Atari 1400 XL.



Atari 1450 XLD.

Atari 400 and 800

John J. Anderson

Right about the time this magazine came out, the last of the Atari 400 and 800 machines went on sale. And when I say sale, I do mean sale. Yesterday I saw a price of $69 after rebate on the Atari 400.

That is a positive steal.

The Atari 800 is available at about $300 after rebate, fully configured to 48K. That is also an excellent price. There is also reason to believe that as new Atari models are shipped, remaining stocks of 400 and 800 machines will be discounted even further.

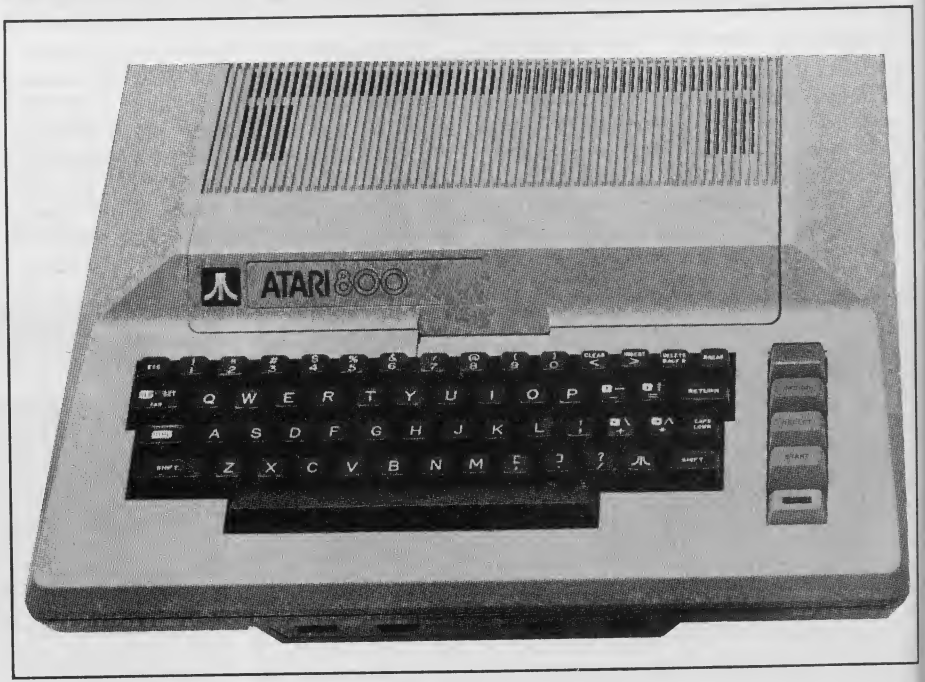
Why should these old Ataris be such a good bargain after all these years? Well the body of software for these machines numbers in the thousands, and much of it is very good. This includes word processors, database packages, business software, and of course, games—lots of games.

Though the models 400 and 800 can be expanded to only 48K, most existing software runs in a 48K environment. It will be a while before we see packages specifically designed for the new 64K Ataris.

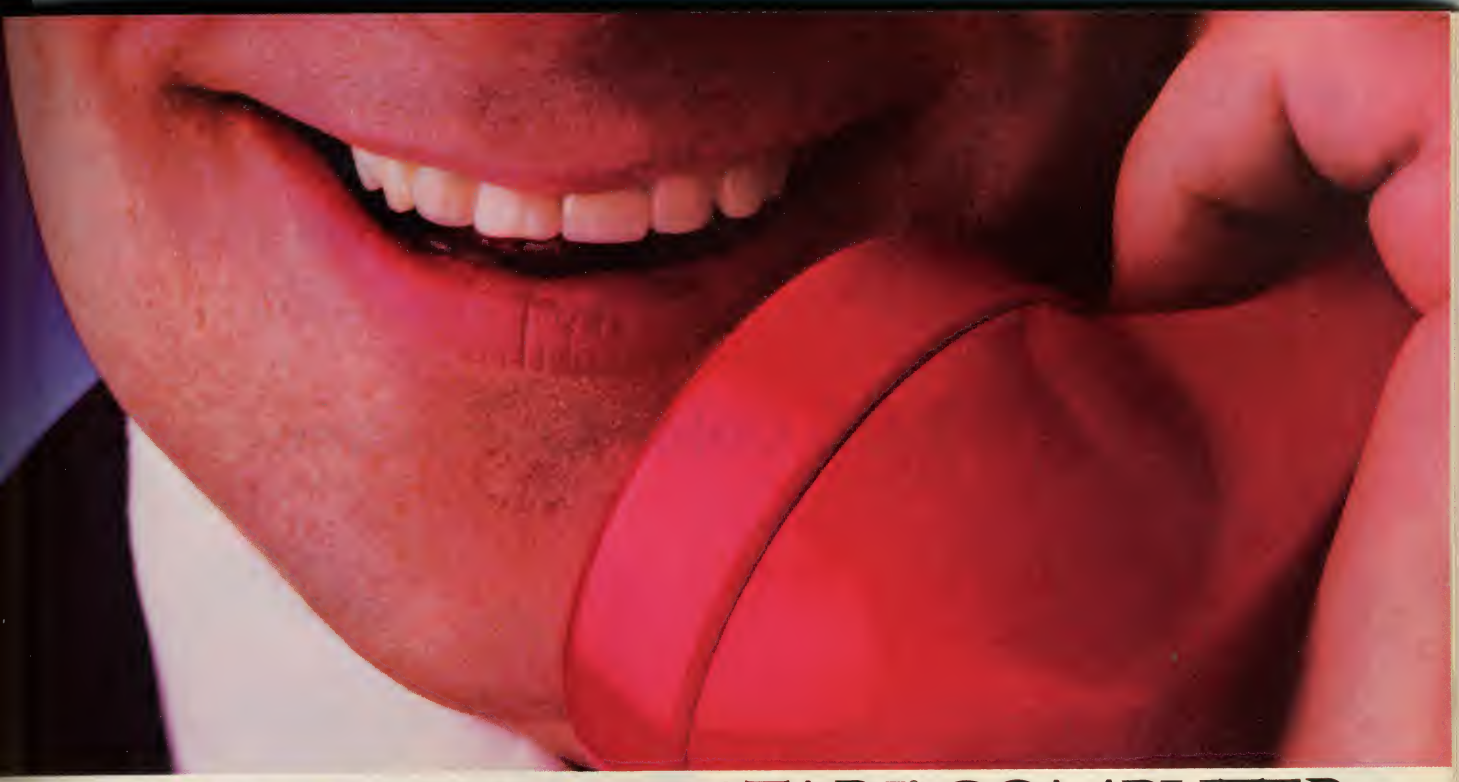
Of course these machines continue to offer the most impressive graphics and sound combination in the low-end market today. Many of the more original and talented software designers around today have discovered the Atari. As a result, third-party support for the machines is very strong.

The new crop of Atari microcomputers to some degree makes the old 400 and 800 machines look like antiques. Although the new machines do have advanced features, this impression is more cosmetic than substantive. The original Atari machines remain powerful and worthy machines, and software for them will continue to be available for decades to come. □

The Atari 400.



The Atari 800.



WHEN YOU BUY AN ATARI® COMPUTER, WE PUT OUR EXPERTISE ON THE LINE.

There's no limit to what you can do with a home computer...and no way any mere instruction manual can help you discover all the possibilities.

So ATARI gives you the extra help you need: an ATARI computer expert to answer your questions. Free. He'll help you write your own programs, learn how to do new things, and diagnose problems when the things you're trying to do just don't work out.

It's the ATARI Help Line. A toll-free help-and-information service to help you get more out of your ATARI Computer. Just call 1-800-538-8543.*

And if you ever need anything fixed, ATARI has over 1,600 ATARI SERVICE℠ Centers nationwide. You'll find the nearest one listed under "Computers" in your Yellow Pages.

ATARI SERVICE isn't the only good reason to buy an ATARI system. But it's an awfully good reason not to choose any other kind.

ATARI SERVICE
FACTORY AUTHORIZED NETWORK

CIRCLE 141 ON READER SERVICE CARD

1-800-538-8543*
THE ATARI SERVICE℠ "HELP LINE."

© 1983 Atari, Inc. All Rights Reserved. ®A Warner Communications Company

*California: 1-800-672-1404

TRS-80 Color Computer

Owen Linzmayer

In 1977 Radio Shack entered the home computer field with the TRS-80 Model I, an unassuming 4K computer built around a Z80 microprocessor. The machine had many devoted users; it also had many flaws. Several years later, Tandy offered the devoted users the updated Model III, a compatible 16K computer that is essentially a revised edition of the initial Model I. Sales were feverish until machines such as the Atari 400, capable of producing hi-res color graphics displays, appeared on the market and began to dilute Radio Shack sales. Tandy soon struck back in an attempt to regain its number one position. The weapon: the TRS-80 Color Computer.

Like the Model I before it, the minimum configuration Color Computer came with only 4K of RAM, upgradable to 32K. The system set you back a whopping $400. Today you can buy a brand new 16K Color Computer, upgradable to 64K, for half that price. You can no longer purchase the 4K model.

Measuring 14.75" x 13.75" x 3.5", the Color Computer is similar in size and shape to the Apple II, but the case is gray plastic and the top does not pop open to expose the innards.

The "Chiclet" style keyboard has 53 alphanumeric keys set up in the standard QWERTY format. It is the strange plastic keyboard, somewhere between membrane and full-stroke, that helped stigmatize the Color Computer as an expensive child's toy. The problem has been alleviated by a third-party manufacturer, Mark Data Products, which sells an inexpensive full-stroke replacement keyboard for the Color Computer that makes the machine suitable for serious programming and word processing. Continuing our inspection of the external features, we find the power switch located in the lower lefthand corner on the rear of the computer. This inconvenience is magnified by the fact that there is no on/off indi-

creative computing
HARDWARE PROFILE

Name: TRS-80 Color Computer
Type: Personal
CPU: 6809E
RAM (min/max): 16K/64K
ROM: 8K or 16K Extended Basic
Type of keyboard: 53-key chiclet-style
Text resolution: 32 x 16
Graphics resolution: 256 x 192
Number of colors: 9
Sound capability: Yes
Ports: 1500-baud cassette, RS-232C I/O and two joystick connectors
Dimensions (HxWxD): 3.5" x 14.75" x 13.75"
Documentation: Abundant
Price: $199
Summary: With its price dropping and software support rising, definitely worth considering.
Manufacturer:
Radio Shack — Tandy Corp.
1800 One Tandy Center
Fort Worth, TX 76102

"Microsoft® Multiplan™ allows me to explore more alternatives in less time. I think it leads to better management decisions."

Edward R. Schwinn, Jr.
President, Schwinn Bicycle Company

"Multiplan software helps me make better business decisions. It's as simple as that. With Multiplan on my microcomputer, I can explore a number of alternatives faster. That's really important to me in planning and tracking my totally hand-crafted Schwinn Paramount Bicycle. As with anything handmade, cost control and product planning are major considerations. For instance, Multiplan lets me study the effect of the learning curve on overall productivity. And although we have a mainframe computer, I find that Multiplan is a tool that allows me to personally examine my business options—without spinning my wheels."

A tool for decision makers. Microsoft Multiplan is a microcomputer software program that can help you too. In many ways. You can analyze cash flow. Plan budgets. Forecast income. Manage production. Multiplan allows you to set up an electronic worksheet for whatever your need may be. And, it lets you explore alternatives faster because when you make one change you immediately see the results of that change throughout the worksheet and on any related worksheets. Just change one number and every number that depends on it is adjusted automatically.

In plain English. You won't have to learn a cryptic language to use Multiplan. It takes commands in plain English. And, it will prompt you as you go along by telling you what to do next. There's even a HELP key in case you need help at any point. Press it and it gives you information to get you going again.

Backed by our knowhow. There are a lot of good reasons to use Microsoft software. And among the best is "knowhow." Microsoft put BASIC, the first microcomputer language, on the very first microcomputer, and today, Microsoft software is running on well over a million computers. Worldwide.

See it in action. If you'd like to explore more alternatives yourself, ask your local computer dealer for a demonstration of Microsoft Multiplan. Multiplan is available for most popular personal computers, including Apple,® the IBM® PC and computers that use CP/M-80® or MS™-DOS operating systems. It's a good management tool for building bicycles. It's also a good management tool for building businesses. Like yours.

BETTER TOOLS FOR MICROCOMPUTERS

MICROSOFT™

Microsoft is a registered trademark, and Multiplan, MS, and the Microsoft logo are trademarks of Microsoft Corporation. Apple is a registered trademark of Apple Computer, Inc. IBM is a registered trademark of International Business Machines, Corp. CP/M-80 is a registered trademark of Digital Research, Inc.

CIRCLE 155 ON READER SERVICE CARD

BEAT THE HIGH COST OF SOFTWARE

Before you buy any more software, you owe it to yourself to join S♡FTRADERS™, the fastest growing worldwide trading network. Members swap software and info for all computers.

Annual membership includes:

- Quarterly trading directories
- Monthly and flash updates
- Personalized trader listings
- Trader support systems
- Plus much more

Imagine having access to hundreds, even thousands of programs, each costing no more than the price of a stamp or phone call. Join now to beat the price increase and find out about the new member $$ offer. $49.95 U.S. $64.95 FOREIGN. SASE for info.

S♡FTRADERS™ INTERNATIONAL
1610 Shomaker Dr.
Murphysboro, IL 62966

CIRCLE 129 ON READER SERVICE CARD

FREE CATALOG!

Just let us know and we'll mail you a FREE *Creative Computing* Catalog – 16 pages filled with books, buyer's guides, magazines, and more!

To get your FREE catalog, write to: *Creative Computing* Catalog, Dept. NA1X, 39 East Hanover Ave., Morris Plains, NJ 07950.

SHELF CONSCIOUS?

Now you can organize your copies of
CREATIVE COMPUTING

Now your magazines can be a handsome addition to your decor, well organized, and easy to find, thanks to these durable library-quality cases or binders. They're made of luxury-look leatherette over high-quality binder board. And both styles are custom-designed for this or any other magazine you save, with size, color and imprint selected by the publisher. FREE transfer foil included for marking dates and volumes.

Magazine binders
holds your issues on individual snap-in rods, combining them into one volume. $7.95 each; 3 for $22.50; 6 for $42.95. Mixed titles OK for quantity prices.

Open-back cases
store your issues for individual reference. $6.95 each; 3 for $19.75; 6 for $37.50. Mixed titles OK for quantity prices.

For faster service,
CALL TOLL-FREE
800-526-0790
(In NJ only 201-540-0445)

Creative Computing
P.O. Box 5120, Philadelphia, PA 19141
Please send: ☐ Cases ☐ Binders

TITLE	QUANTITY
Creative Computing	
Other:	

☐ **PAYMENT ENCLOSED $**_____* Add $1.00 *per order* for postage and handling. Outside USA add $2.50 *per unit* ordered; send US funds only.
☐ **CHARGE** (Minimum $10): ☐ American Express ☐ MasterCard ☐ Visa

Card No._____ Exp. Date_____
Signature_____
Print Name_____
Address_____
City/State/Zip_____
*Residents of PA add 6% sales tax.

cator anywhere on the Color Computer. With a ten-cent LED and a few minutes, you can add this yourself. But the question arises, "Why didn't Tandy include this feature in the beginning?"

Also found on the backside of the computer is the reset button. While I appreciate having the reset button located in such a way that it cannot be pressed accidentally, I think its present position borders on the absurd.

On the rear of the Color Computer are two 5-pin DIN sockets into which you can plug the right and left joysticks. Not included with the system, the joysticks cost an additional $25 a pair. The variable resistance joysticks use 100K ohm potentiometers to return analog signals to the computer. Since they are poorly designed and not self-centering, most people eschew the Radio Shack joysticks, choosing instead one of the special adapters available from aftermarket sources, which enable you to use Atari-compatible controllers with most of the software now in existence.

Program Storage

If you are using cassettes as your storage media, you must have a tape recorder connected to the 5-pin DIN socket on the back of the computer. Programs are saved to and loaded from tape at 1500 baud—three times faster than the Model I TRS-80. Located right next to the cassette connector is an RS-232C serial I/O port that uses a unique 4-pin DIN connector. This interface allows the Color Computer to communicate with printers, modems, and other computers. Adjacent to these two sockets are the RCA video output plug and the television channel (3/4) selector. The output connects directly to any standard TV set (300 ohms) through a small switch box.

On the righthand side of the computer is a cartridge slot. Using a 40-pin edge connector, the Color Computer can accept ROM "program paks" which sell for $20 to $40. Radio Shack offers a wide range of cartridges including entertainment, education, and application programs.

If you want to add a disk drive to your computer, the disk operating system (DOS) program pak plugs into the cartridge slot, and the drive cable is attached directly to the pak.

CPU and Display

The Color Computer uses a powerful 6809E 8-bit processor. This cpu has a clock speed of 0.894 MHz. Compare this to a clock speed of 2.03 MHz for the Z80 found inside the Model III TRS-80, and you realize that the Color Computer is relatively slow.

The Color Computer is capable of producing a video display 32 characters wide and 16 lines deep. In addition to normal ASCII characters, the Color Computer also has 16 graphics characters. To enter the upper/lowercase mode, you must press SHIFT 0. The lowercase letters appear on the TV screen in reversed colors (green on a black background). As in the case with most of the shortcomings of the machine, third-party modifications are available to give you real lowercase letters with true descenders.

With Extended Basic, color graphics capabilities range from 32 x 64 pixels (eight colors) to 192 x 256 pixels (one color and the background). Higher resolution may be achieved through machine language programming either with or without Extended Basic.

Documentation

Like all TRS-80 computers, the Color Computer comes with an excellent manual. Written in plain, everyday English, *Getting Started with Color Basic* carefully and thoroughly explains each Basic command. It assumes that the reader does not know anything about computers, but at the same time, is not insultingly simplistic. The second manual, *Going Ahead with Extended Color Basic* is written in a similar fashion.

You may also want to pick up a copy of the *TRS-80 Color Computer Technical Reference Manual*. As you can probably guess, it contains information for serious programmers and technicians. It is expensive—$14.95—but tells you just about everything you need to know about how the computer works.

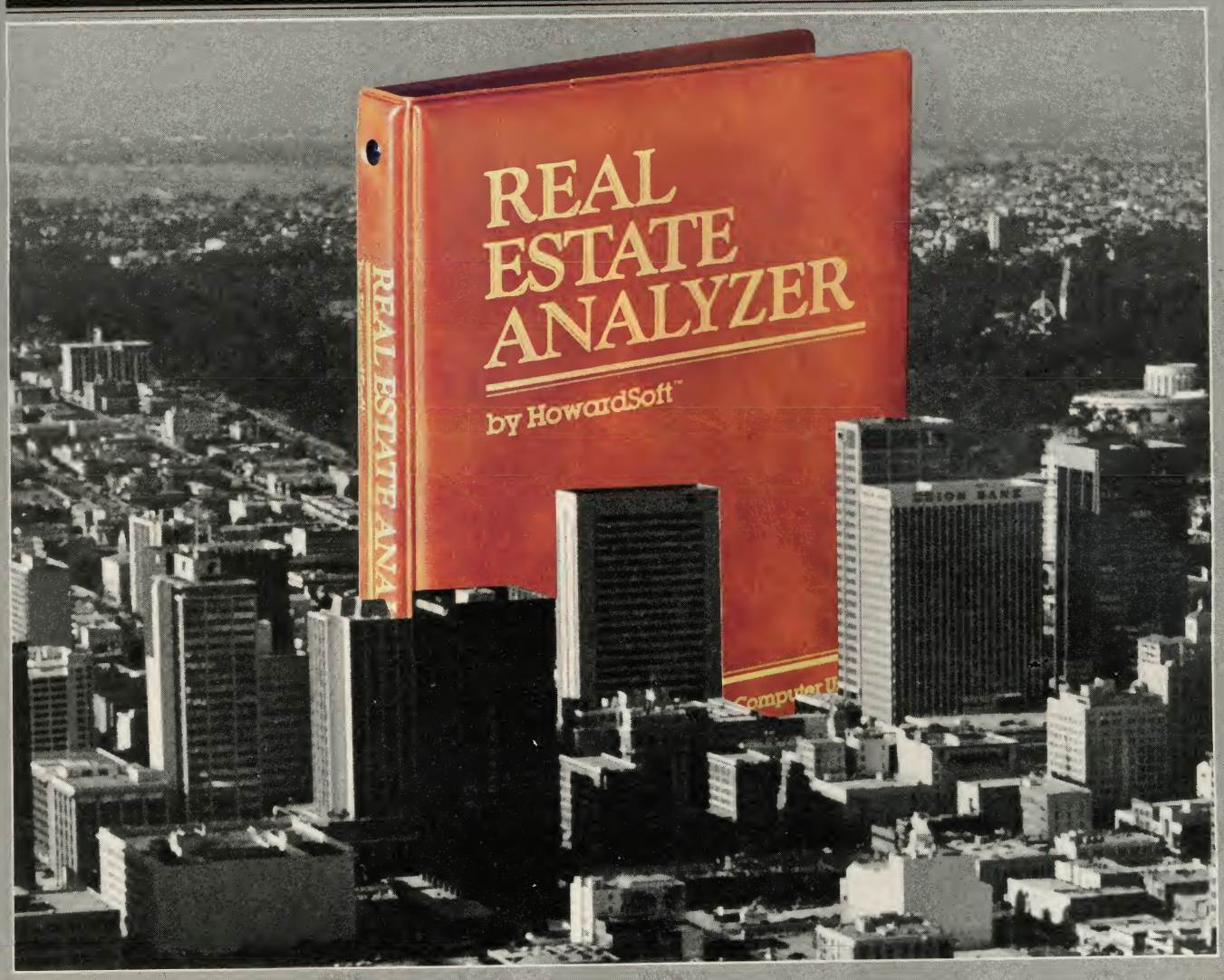
Software

When the Color Computer first came out, most of the software available was converted from other systems; few packages took advantage of the specific capabilities of the new machine. Because Tandy refuses to sell third-party software or hardware in Radio Shack stores, the Color Computer got off to a slow start. Private newsletters and user groups took a while to spring up, but they were soon followed by software houses and magazines devoted entirely to writing for and about the Color Computer. Some of the best software for the Color Computer comes from DataSoft, Intracolor Communications, Spectral Associates, Computerware, and Aardvark.

Industry analysts estimate that there is an installed base of 300,000 to 400,000 Color Computers. Since Tandy refuses to confirm or deny these figures, they remain estimates only. Production has been halted and the original Color Computer will be sold only until supplies are exhausted.

By the time you read this, Radio Shack should be marketing a compatible second-generation machine, the Color Computer II. □

THE BEST STANDS OUT



*PRACTICAL DECISION-MAKING
aids buy/hold/sell decisions by projecting cash flow & profitability; computes ROI, IRR, ROE, and FMRR.

*REALISTIC SIMULATIONS
models economy based on 5 separate components of inflation for realistic "what-if" studies

*UP-TO-DATE WITH CURRENT MARKET
takes into account rent control, runaway inflation, money rates, creative financing, and complex lease packages

*UP-TO-DATE WITH TAX LAWS
includes latest tax laws for depreciation (including ACRS), recapture, & capital gains

*PROFESSIONAL PRINTOUTS
detailed 10-year tables of cash flow and ROI in personalized, paginated report format

*ERROR TOLERANT
designed for ease of use by newcomers to computers; fully tested by real estate professionals

*INSTRUCTIVE MANUAL
100-page book includes easy-to-follow examples and detailed instruction in investment analysis

The best investment clearly stands out when you use computer-aided decision-making with the Real Estate Analyzer by HowardSoft. Applying the latest techniques in investment analysis, this software produces detailed, objective projections of cash flow and overall investment return for any commercial or residential property. Even the most dissimilar deals are compared fairly because inflation rates, creative loan packages, complex depreciation schedules, involved leases, and complex tax laws are all taken into account.

for all Apple and IBM-PC Computers
at your local dealer

HSS Howard Software Services
for the SERIOUS Personal Computer User

8008 Girard Ave., Suite 310 | La Jolla, CA 92037 | (619) 454-0121

CIRCLE 147 ON READER SERVICE CARD

SpectraVideo SV-318 and SV-328

David H. Ahl

The SpectraVideo family of computers is an interesting international effort. Overall management, marketing, and direction come from the company headquarters in New York; systems software development including the powerful implementation of Microsoft Basic was carried out by ASCII Microsoft in Tokyo; while the manufacturing is done in Hong Kong. The SV-318 and SV-328 are the products of this unusual, but highly successful three-way marriage.

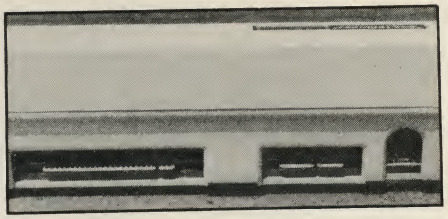
While this is a review of both machines, we will generally speak of the computer (singular) and point out the differences between the two models (built-in memory and keyboard) in the appropriate places.

Functional Console

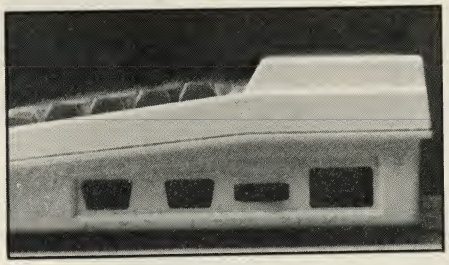
The computer is housed in a sturdy white plastic case measuring 15.5" x 8.7" which slopes from a height of 1.7" at the front to 3" at the rear. Immediately visible on the top of the case is the keyboard and a red LED indicating that the power is on. Although a small feature, this is much appreciated; so many computers today provide no indication of whether they are on or off.

Also on top of the case is a hinged cartridge port in which to plug in software packages that come in cartridge form.

Moving to the right side, we find a male 4-prong power supply input. The power supply is a heavy duty unit providing 14 volts at 2 amps and 8 volts at 3 amps. This is three to four times the power offered by the average home computer power supply; thus it ought to more than enough reserve power for all the peripherals you may ever want to add.



Rear of computer has bus expansion slot, cassette slot and video jack.



Right side of SV-318 and SV-328 has two joystick ports, on/off switch, and power receptacle.

Also on the right side are a rocker-type off-on power switch and two game controller ports. These are standard DB-9 receptacles for Atari-type joysticks, paddle controls, and track balls.

On the back of the console are an expander port, cassette port and video output port. An RF modulator furnished with the system plugs into the video port and, according to the specs, will produce NTSC, PAL or SECAM output as appropriate. It uses a standard 5-pin, 180-degree DIN connector which can be easily wired to provide a composite video signal to a monitor with separate audio output.

The cassette port connects to the SpectraVideo stereo data/audio cassette recorder. The computer has lines for sending and receiving data, motor control, and power.

The expander port allows the computer to be connected to a single slot expansion adapter or a 7-slot expansion box. More about this later.

A Complete Package

The attractive box contains nearly everything you need to start computing. You get the computer/keyboard unit, RF modulator (with 3' cable), shielded video cable (5'), video switch box, power

THE PERSONAL PRINTER BUILT LIKE A SHERMAN TANK PERFORMS LIKE A CONCERT GRAND.

Why We Get Encores. Okidata takes center stage with a cast of printers that can't be outperformed. All eight dot matrix printers offer you more features for your money than you can find anywhere else. Pick your tempo: data processing at speeds from 80 to an exceptional 350 cps; to stress a point, enhanced and emphasized printing at up to 100 cps; outstanding letter quality printing at speeds three times faster than most daisywheels — up to 85 cps. Add a full range of graphics capabilities, downline loadable character sets for creating personalized typefaces and symbols, and your print repertoire is virtually unlimited.

We Play On and On. Our virtuosos feature rugged steel frames, laser-welded parts, and our long-life, non-ballistic print head warranted for up to one full year. With this tank-toughness you'd expect Okidata to have the lowest warranty claim rate in the industry. And we do: less than ½%.

In Tune with All Major Computers. We've designed each of these finely tuned instruments to be harmonious with all the major names in personal computers. And to give you more than you'd get from the major computer name printers. After all, we specialize in printers. The computer folks specialize in computers. (That's why MOST buy their printers from somebody else).

Larger Selection. Smaller Prices. Because we make more printers than anybody else, we can give you just the right one to fit your specific needs. Not to mention your budget. Suggested retail prices range from $449 to $2995. Call 1-800-OKIDATA (in NJ, 609-235-2600) for the dealer nearest you. Both you and your computer will enjoy the performance.

OKIDATA

Mt.Laurel, NJ 08054

A subsidiary of Oki Electric Industry Company Ltd.

CIRCLE 122 ON READER SERVICE CARD

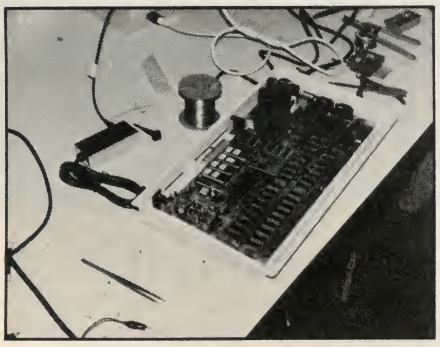
supply, instruction manual, and warranty card.

The manual has eight pages of photos depicting all aspects of hooking up the system and getting it into operation. Another helpful feature is the built-in diagnostic check that automatically occurs upon powering up the system. A successful self-test is signaled by a beep in the TV speaker about 1-1/2 seconds after turning on the power switch.

Upon a successful power up, the SpectraVideo logo appears in three colors followed by a message indicating the version of Microsoft Basic in the system and the number of free bytes of user memory. A standard SV-318 has 32K of RAM; 16K is allocated to graphics support and the other 16K is user addressable memory. Well, not quite; 3569 bytes are reserved for overhead, I/O, and the like. Thus an unexpanded 16K SV-318 has about 12.8K truly usable bytes and a standard 32K SV-328 machine has 29.2K. Both computers are expandable, with 16K or 64K external memory packs, to a maximum of 256K.

Computer/Keyboard Unit

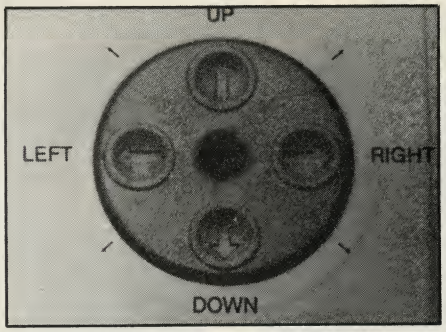
The SV computers use the Z80A mpu chip operating at 3.6 MHz; until recently, most personal computers used a 2 MHz clock rate. In theory, this should make the SV computers faster than



Guts of an SV-318 at the plant in Hong Kong.

other comparable machines. In practice, the issue of speed is somewhat more complicated.

The version of Microsoft Basic used by the SV computers automatically makes all variables double precision. Hence, a variable occupies eight bytes, and every time it is called, those eight bytes must be moved. In contrast, most other small computers use single precision variables (four bytes) so there are correspondingly fewer memory accesses when a variable is called. The bottom line is that in a normal Basic program, the SV computers are considerably more accurate than, say, the Mattel Aquarius or TRS-80 Model 4, but only about half as fast. A slight improvement in speed

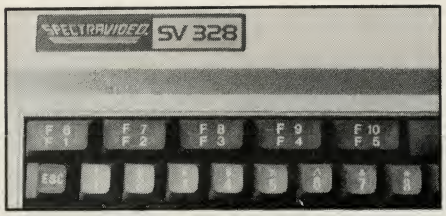


SV-318 has a cursor directional pad.

(about 10%) can be obtained by defining variables as single precision.

On the other hand, the speed advantage is apparent when using machine code. Also, as we will see later, the inclusion of several powerful Basic and graphics commands makes programming much simpler, particularly for animated graphics. This may yield a speed advantage as well, since one command does the job of many.

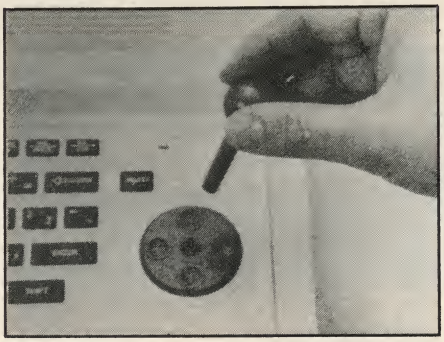
The keyboard on the SV-318 has 71 rubberized Chiclet-style keys. In addi-



Each of the five function keys can select two functions.

tion to the expected alphabetic, numeric, and symbol keys, the keyboard has five function keys, three program control keys (STOP, ENTER, and CONTROL), and six miscellaneous keys.

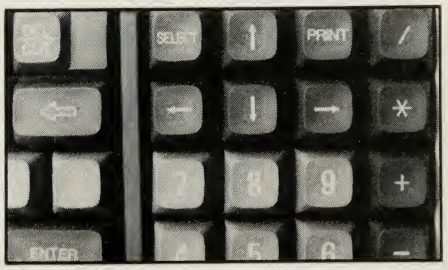
Each of the five control keys activates two functions depending upon whether SHIFT is pressed. The function of each of these keys is shown on the bottom of the TV display. The functions controlled by these keys are color (to set character, border, and background colors), auto line numbering, list (the entire program



A joystick handle can be added to the cursor directional pad on the SV-318.

or the last line you were working on), run, cassette load, GOTO (allows execution of a program from any point), and continue. In addition, all ten of the function keys are user programmable with a simple statement, for example, KEY 1, "Creative". From then on, whenever function key 1 is pressed, the word Creative will automatically appear.

The six miscellaneous keys are caps lock, clear screen and move cursor to home position, insert, delete, and left and right graphics. These last two keys are used to select the 52 graphic symbols on the keyboard (each of the 26 letters can produce two graphics symbols).



SV-328 has arrow keys for cursor movement.

To the right of the keyboard on the SV-318 is a joystick/cursor control pad. A joystick may be screwed into the center of the pad for use in games or to move the cursor around the screen in any of eight directions. Actually, we found it most convenient to move the cursor by pressing the indentations in the pad rather than using the joystick at all.

The feel of the keyboard was as good as could be expected from the Chiclet-style keys. With each keypress, an audible keyclick sound is produced in the TV speaker to aid in accurate typing. This can be turned on or off with the commands CLICK ON or CLICK OFF.

The SV-328 differs from the SV-318 in that it has a full-stroke keyboard with 86 keys. In addition to the keys on the SV-318, the SV-328 has a numeric keypad and arithmetic function keys to the right of the main keyboard, and the cursor control pad is replaced by four directional keys. The keyboard has an excellent tactile feel, and we had no need to leave the keyclick sound on.

Extended Microsoft Basic

The version of Microsoft Basic in the SV computers is one of the richest we have ever seen. As mentioned earlier, all variables are automatically double precision unless specified otherwise in your program. This yields 16.8 decimal digits of accuracy which beats hands down any computer that we have tested with the exception of the calculator-like TI CC-40.

The computer has four types of variables: double precision, single precision, integer, and string. A variable type can be declared at the beginning of the program (DEFSNG, DEFINT, etc.) or by means of a suffix attached to the variable name (I%, B!, F#, A$).

There are 26 Basic commands. These include the usual NEW, RUN, SAVE, and the like, but we found a number of unusual commands as well.

KEY LIST lists the contents of the programmable function keys. MERGE brings a second program into memory and merges it with the one already there; if there are duplicate line numbers, the second program takes precedence.

MOTOR ON or. OFF turns the cassette motor on or off while SOUND ON or OFF turns the cassette audio track on or off. SWITCH causes the computer to use a different memory bank. WIDTH sets the width of the screen display and TRON and TROFF turn the trace function on and off.

An extended list of 29 Basic statements includes BEEP and SOUND (R,B) which puts a sound byte, B, into one of the three sound registers, R. Control of the three sound channels is extensive and includes pitch (over eight octaves), amplitude, envelope period, envelope shape, and rhythm. In addition, there is a noise generator. To take full advantage of this sound capability, the SV computers include a Music Macro Language with 11 additional commands.

Other extended Basic statements include SWAP (exchanges the value of two variables), WAIT (suspends program execution to read an input port), OUT (puts a byte to an output port), DEF USR (defines an entry address for a machine language subroutine), and ERASE (releases space used by a variable array).

The Basic operators include the expected arithmetic and Boolean operations. In addition, we find MOD (integer modulus), XOR (exclusive OR), EQV (equivalence), and IMP (implication). The arithmetic functions are what would be expected; however, SpectraVideo has thoughtfully provided in the User's Manual a table of 20 inverse and hyperbolic functions not directly implemented on the computer, showing the formula to calculate each one.

Again, the string functions are more or less as expected with the addition of HEX$ and OCT$ (converts numbers to hexadecimal and octal strings), and STRINGS$ (L,E) which returns a string of L length with the numeric value specified by expression E.

The I/O and interrupt control functions and commands are fascinating and allow amazing control of printers, terminals, joysticks, and other I/O devices. The SV computers have a built-in timer which can be accessed from Basic programs to perform all kinds of tricks. We were especially interested in the statement ON SPRITE GOSUB which causes the program to jump to an address when it detects a collision between two sprites.

Sprites are little graphics critters which can consist of up to 32 bytes which define colors and pixels on the screen (rockets, tanks, people, or any moving object). A program can use up to 32 sprites, many more than are available in other comparably priced computers. Unfortunately, neither the User's Guide nor the Quick Reference Guide included with the computer describes how to use sprites in a program. (*Creative Computing* had a multi-part tutorial on the use of sprites about a year ago.)

In addition to the various sprite commands, the SV computers have many other graphics statements which make graphics programming a real joy. These include CIRCLE, LINE, GET, POINT, PSET, VPEEK and VPOKE (peek and poke to video screen locations), and DRAW. This last command is used to draw on the screen with a special graphics macro language which has 14 additional commands.

On-Screen Editing

More and more computers are being produced today with on-screen editing to replace the older systems which required an entire statement to be retyped or a special editing function to be invoked. With on-screen editing, you simply move the cursor to the place requiring a change, type the change, press RETURN, and presto, the change is made. Good on-screen systems include insert and delete keys, and allow the duplication of statements by simply typing a new line number over the old one; the SV computers have these features.

In addition, the SV computers have several other editing and cursor movement functions which are invoked by pressing the CONTROL key in combination with a letter. Some of these functions include backspace-and-delete, cursor to end of line, truncate line (a real joy!), and clear logical line.

The only "missing" editing command that we would like to have seen is Line Insert; however, the only low cost computer on which we have found this command is the Panasonic JR-200.

Graphics Display

As mentioned earlier, the SV computers can drive either a color monitor or a TV set with an RF signal. Naturally the image on a monitor is better, but the computer produces a surprisingly good image on a TV set. Up to 16 colors can be produced simultaneously, although some of them tend to appear very similar. On the other hand, it is rare to want 16 completely different colors on the screen at one time.

The default color for text is a highly legible white on blue, although by means of the color command you can set this to anything you desire.

Normal text resolution is 40 charac-

ters by 24 lines. In Basic, the bottom line is reserved for the function key definitions. Obviously, we thought, there must be a way to turn off this bottom line, but we couldn't find it except in the graphics modes.

There are two graphics modes, low- and high-resolution, appropriately enough. High-resolution provides 256 x 192 pixels; low-resolution has 64 x 48 boxes. In addition, you can use the graphics characters in text mode (40 x 24). While this sounds practically useless, bear in mind that the 52 graphics characters effectively divide each box into four; thus the usable resolution is more like 80 x 48.

Program and Data Storage

SpectraVideo offers both a cassette recorder and floppy disk drive for the SV computers. We had the SV-903 cassette recorder for our evaluation. Unlike other computers, the SV machines cannot use just any cassette recorder. While it might be possible to hook one up, we recommend that you use the SV-903 which is designed for use with the computer.

SpectraVideo cassette recorder has no critical volume and tone adjustments. One channel is digital, the other is audio.

The recorder comes with a single cable which carries power, input and output signals, and control signals to the motor and audio speaker. This is a stereo recorder with programs and data on Channel 1 and audio, if desired, on Channel 2. The recorder has a built-in microphone so you can add your own voice support with your programs.

Digital information is stored at 1800 baud—an in-between speed these days. A 16K program takes a bit over a minute to load.

The SV-902 floppy disk drive is a compact unit which uses single sided, double density disks. The storage capacity is 163.8K per disk. According to SpectraVideo, with the disk drive, the computer is compatible with CP/M software. Naturally, you can't go to the store and buy CP/M disks that will run directly; however, this compatibility opens up the possibility of easy conversion of the huge CP/M software library from both the public domain and commercial vendors.

All these peripherals, as well as modems, printers, and expansion memory, are plugged into the SV computers using either a single slot expansion unit or a motherboard expander with seven plug-in slots. Both of these expanders plug into the back of the computer and receive their power from the computer itself.

MSX — Wave of the Future

SpectraVideo, along with 14 Japanese companies recently announced an agreement with Microsoft to use MSX, a set of specifications for low-end, 8-bit home computers.

Manufacturers adhering to the MSX specification will do their own product design, but the I/O port and major chip functionality has been specified so that all MSX machines will run a common set of software. The MSX spec calls for a Z80A mpu, Texas Instruments 9918 video display processor chip, input/output ports, joystick interface, and a 32K ROM with an enhanced version of the Microsoft Basic interpreter. This version includes support for multivoice music and high-resolution graphics.

Microsoft stated that they expect all the major software companies such as Sierra On-Line, Sirius, Activision, Spinnaker, and others to write software for MSX machines.

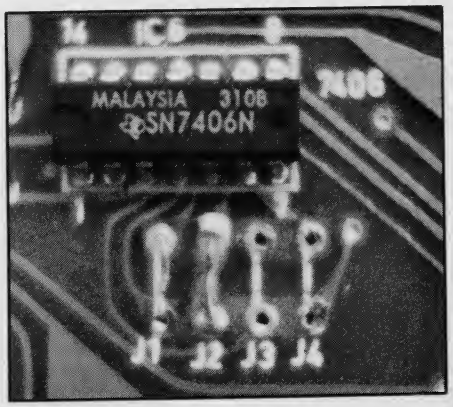
The companies that will be supporting MSX include: SpectraVideo, NEC, Matsushita, Sony, Toshiba, Canon, Fujitsu, General, Hitachi, JVC, Kyocera, Mitsubishi, Pioneer, Sanyo and Yamaha. *—DHA*

Printer

SpectraVideo offers a printer, model SV-901, which is an 80-column, dot matrix unit that operates at 50 characters per second. This popular printer, made by Seikosha, is also sold by several other computer manufacturers as well as by Leading Edge, who call it the Banana.

The SV-901 printer will produce both text and graphics output, but alas, there are no descenders on the g, j, p, q, and y.

However, the printer interface will drive any printer with a Centronics parallel interface. Initially, we were unsuccessful in getting any printed output from our SV-328 on any printers here. A call to SpectraVideo revealed that Jumpers 1 and 2 on the printer interface card must be connected for most printers other than the Seikosha unit. This involves taking three screws out of the interface box and soldering two quarter-inch jumpers near the center of the PC board. SpectraVideo tells us that interfaces will be available for both kinds of printer; purchasing the right one is, of course, a better solution than soldering jumpers.



For non-Seikosha printers, Jumpers 1 and 2 must be installed in printer interface module.

Documentation

If there is a weakness in the SpectraVideo line, it is in documentation. The computer comes with a 136-page User's Manual and 22-page Quick Reference Guide. Both are punched for a 6″ x 9″ three-ring binder (included), but the spiral bound User's Guide is better used without the binder.

The User's Manual takes a very different approach to teaching Basic than we have seen before. In particular, it starts with graphics and shows how you can use the computer to design simple pictures and draw them on the screen. This is an excellent approach and builds up interest quickly among new users.

Unfortunately, it doesn't go far enough. While it deals with all the standard Basic and graphics commands, it doesn't discuss any of the nifty extended features of the SV computers. Nowhere are we told how to use sprites. The amazing sound capabilities of the machine are covered in only the most cursory way.

The Quick Reference Guide has a short description of most of the Basic statements and commands and will be the document of choice for the skilled programmer; however, it too fails to describe the commands in sufficient detail to allow programs to be written without a great deal of experimentation. Indeed,

Look over the Rainbow.

Learn Rainbow™ computer-based instruction ends manual labor. No slaving over computer manuals, you learn to use the Rainbow on screen, in minutes, not months.

The Rainbow shows more character, 132 columns instead of the usual 80. So you can screen a 12 month spreadsheet, without losing 6 months.

One of the Rainbow's best features is the service and support from Digital, the world's second largest computer company.

Keyboard is designed with separate function groups and special keys like "HELP", "DO", and "NEXT SCREEN".

The Rainbow's sleek, comfortable keyboard with standard typewriter keypad fits almost anywhere, even on your lap.

Of the hundreds of software applications now available many are Digital Classified and serviced.

Only the Rainbow automatically runs the widest range of the popular 8-bit *and* 16-bit CP/M® software.

After you look over the Rainbow™ personal computer on paper, look over the Rainbow in person. To learn where, call 1-800-DIGITAL or write **Digital Equipment Corporation**, 200 Baker Avenue, Concord, MA 01742.

Not even the world's largest computer company gives you so much. But the second largest does.

digital

© Digital Equipment Corporation 1983
CP/M is a registered trademark of Digital Research, Inc.

CIRCLE 163 ON READER SERVICE CARD

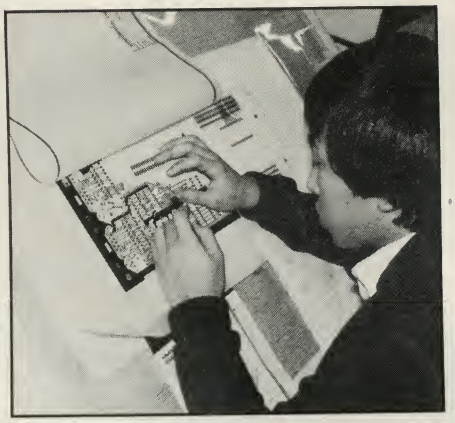
A fully-configured SV-328 system at the plant in Hong Kong.

after an afternoon of experimentation, I had more pages of notes than there were pages in the Quick Reference Guide.

However, it is our expectation that the SpectraVideo computers will achieve a strong market position and publishers will leap into the documentation void with enthusiasm. We are sure that authors will be eager to tell the world how to get the most out of a machine with these capabilities.

Software and Support

SpectraVideo is no newcomer to the personal computer market, even though this is their first computer. They have been successfully marketing several ex-



Laying out one of the interface boards.

cellent games and a joystick for the Atari VCS for some time. At CES, we were amazed at the lineup of software they had running on these computers, the prototypes of which are barely six months old.

SpectraVideo had a spreadsheet package, *MultiPlan, MultiTool-Filer,* home accounting programs, a word processing package, five utility packages, 15 or so educational programs, and scores of games. Moreover, they have announced an attachment which allows Coleco-Vision games to be played directly on the SV computers.

While SpectraVideo does not seem to be encouraging third party software manufacturers to develop software for the computers, they have not ruled it out either.

As far as service goes, at this point, it is a big unknown. Obviously, mass market outlets are not in a position to offer service other than exchanging the unit outright, hence, this will probably be the approach for service under the initial 90-day warranty.

Beyond that period, SpectraVideo tells us that they have an agreement with Carterfone to provide nationwide service through the Carterfone service organization. This seems like a good approach since Carterfone is a well-established, professional organization with electronic servicing experience.

318/328 Differences

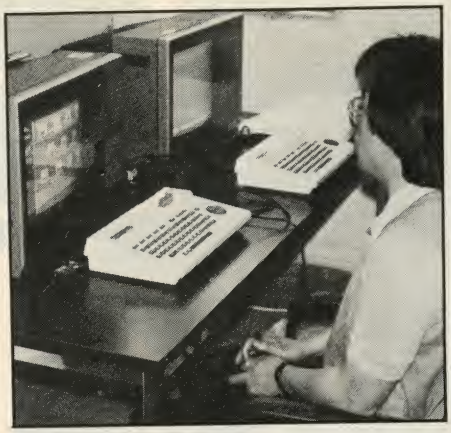
As mentioned earlier, the 328 has a full-stroke keyboard compared to the rubberized keys on the 318. The 328 also has 80K of RAM (64K of user RAM and 16K of video RAM) compared to 32K (16K user, 16K video) on the 318.

In addition, the 328 has 16K more ROM than the 318. This contains some rudimentary word processing software similar to that on the TRS-80 Model 100 and NEC 8201, although some print formatting and the ability to save and load files are included. This word processing package uses the cursor control keys for movement, has a "cut and paste" capability, search (but not replace), and block move. It is always in insert mode; in comparison, most other on-screen word processors operate in overstrike mode. This is not a disadvantage, but rather a different approach to accomplishing the same end.

The expanded ROM also contains software to make the 328 act as a terminal, again similar to the Model 100/NEC 8201 twins. This is a handy package which makes it very easy to communicate with other computers or timesharing information services.

In Summary

The SpectraVideo SV-318 and SV-328



SpectraVideo has demonstrated many software packages which should be on dealer shelves before long.

computers offer an incredible array of features at very attractive prices. The extended Microsoft Basic language has outstanding graphics, sound, and I/O capability. The keyboard on the SV-318 is among the best of the Chiclet-style units while the full-stroke keyboard on the SV-328 is outstanding compared to any other. The on-screen editing is a joy, and the "extra" function keys make programming fast and easy.

The full array of peripherals means you will not quickly outgrow the system. The CP/M capability with the disk drive opens up a potentially huge library of software that augments the impressive lineup already announced by SpectraVideo.

The one glaring weakness in an otherwise outstanding offering is that the documentation just doesn't provide the information needed to exploit the advanced capabilities of the computer. Nevertheless, at the suggested retail price of $299 for the basic SV-318 and $595 for the SV-328, we agree with SpectraVideo, that this is a "computer system you'll grow into, not out of."

SpectraVideo Inc., 39 W. 37th St., New York, NY 10018. □

"I see you turned in your expense account on a mobius strip . . . very funny . . ."

Which do you think is the more sophisticated computer?

Epson.

The big differences between the Epson HX-20 Notebook Computer (on the left) and the Apple Computer (on the right) are: 1) the HX-20 doesn't need a power cord, 2) the HX-20 weighs only about four pounds, and 3) the HX-20 costs a lot less money.

The Epson HX-20 Notebook Computer has a full-size keyboard, a built-in LCD screen, a built-in printer, 48K of combined RAM and ROM memory, and an internal power supply that will keep it running for over 50 hours. So you can do computing and word processing virtually anyplace you happen to be. Whereas, with the Apple Computer, you can only go as far as an extension cord will take you.

And on the HX-20, you get communications interfaces, upper and lower case letters, five program areas, a full 68 keys including an integrated numeric key pad, an internal clock/calendar, and the screen and printer. Standard. On the Apple, you pay something extra for each feature — if you can get them at all.

All of which makes the take-it-anywhere HX-20 perfect for business executives, salespeople, students, kids — anyone who's looking for an affordable, practical way into computing.

Portable. Powerful. Affordable. Sophisticated. The extraordinary HX-20 Notebook Computer. Find out just how extraordinary. Call (800) 421-5426, in California (213) 539-9140 for your nearest Epson computer dealer.

EPSON
EPSON AMERICA, INC.

CIRCLE 164 ON READER SERVICE CARD

Epson HX-20 Computer

David H. Ahl

The Epson HX-20, introduced in the fall of 1982, was the first of what have come to be known as notebook computers. Now, a year later, with five rivals competing in the notebook computer market, we find that Epson has updated its product and made it an even more viable competitor.

For this review, we obtained a new HX-20 with the built-in SkiWriter word processing software to go along with our year-old original prototype model.

While we cannot report definitively about reliability and support, we speculate that they are likely to be excellent, given the outstanding reputation of Epson in the printer market. For a "one of the pack" company three years ago to emerge as the dominant supplier of dot matrix printers worldwide indicates they are doing a lot of things right. Contributing to this success is undoubtedly some guidance from the Seiko parent company, but mainly an excellent management team in the U.S., Japan, and other countries.

Figure 1. Top view of HX-20. The computer is about the size of a piece of paper.

A Compact Portable

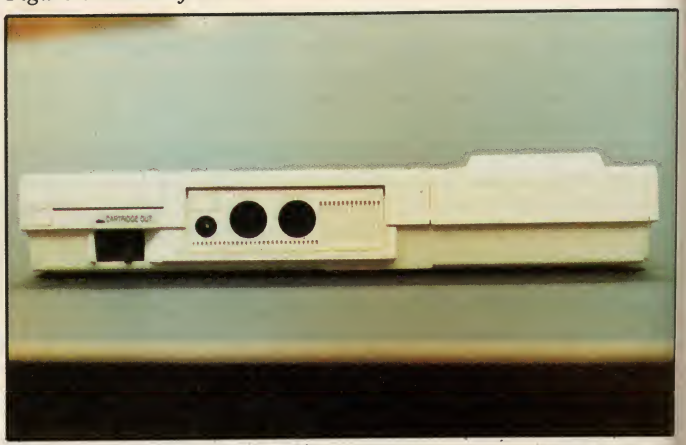
As mentioned above, the HX-20 is about the size of a three-ring binder and, at 3½ pounds, not much heavier. It fits easily into an attache case or slipcase. Unlike some portable videotape machines that require a battery which weighs nearly as much as the machine itself, the HX-20 rechargeable battery is built-in and included in the 3½ pounds. The nickel-cadmium batteries can keep the HX-20 running for 50 hours, yet need only eight hours to recharge. This is very impressive since most ni-cad battery run time to charge time ratios are just the opposite.

Most calculators today, even the least expensive units, have an automatic shut off. For example, APF units shut off automatically if nothing has been pressed after seven minutes. The HX-20 lacks this feature which I found a bit surprising.

However, when the HX-20 is shut off, it continues to trickle a small amount of power through the all-CMOS memory,

Figure 2. Right side view of HX-20.

Figure 3. Rear of HX-20.



thus keeping intact all the contents in memory. As long as the unit is recharged from time to time, these programs and data will be stored indefinitely.

Full Stroke Keyboard

The keyboard of the HX-20 is in the standard QWERTY layout with a few extra keys on the right side. In particular, in addition to letters, numbers and the usual symbols, the HX-20 includes two kinds of brackets, four directional arrows, and five keys for providing instructions to the computer. These keys include home/clear, insert/delete, scroll up/down, number, and graph.

The number key is, in effect, a type of shift key which engages a numeric keypad using the keys, m,j,k,l,u,i,o,7,8, and 9. The graph key is also a type of shift key which produces block graphics and symbols from the keyboard.

There are 32 graphics characters in all including a musical note, a tiny telephone, a running man, a car, a jet plane, card suits, and, of course, blocks and lines.

Above the keyboard to the right are eight function keys. Three functions are built-in: pause, menu, and break. The five other function keys may be programmed by the user.

As its name implies, the pause key causes a running program to halt temporarily. Hitting any key causes it to resume.

The MENU key brings up a menu on the screen. On the menu, Number 1 is always Monitor, 2 is Basic, 3 is SkiWriter, and 4 through 7 are user-written programs. More about this later.

Break halts a running program and returns to Basic. The contents of memory are not altered upon pressing it.

Functions such as LIST and RUN execute the command when the key is pressed. Other commands such as LOAD and SAVE appear on the screen followed by a space and wait until the user fills in the rest of the command.

Figure 4. The preliminary documentation was nearly three times as big as the computer. The final typeset and printed documentation is more manageable.

The five programmable function keys come from the factory with certain functions preset:

Key	*Standard*	*Shifted*
1	AUTO	Date/Time display
2	LIST	LOAD
3	LLIST	SAVE
4	STAT	TITLE
5	RUN	LOGIN

Included with the SkiWriter package is a plastic overlay that redefines the five function keys and the PAUSE key to ten word processing functions.

Recessed on the right side of the computer toward the rear is a reset switch. Pressing it interrupts the computer and calls up the initial menu. Also on the right side is an off/on rocker switch.

Other external controls include two for the printer, an off/on slide switch and a paper feed button. A rotary view angle control on the left side actually changes the angle of the LCD elements of the viewscreen slightly to suit your operating position. You simply turn the knob until maximum contrast is achieved.

An Open Window

The display is a 20-character by 4-line liquid crystal display (LCD) unit. It is unlike a calculator in which each number is formed from a combination of seven line segments; instead, the screen consists of 120 x 32 pixels or dots. Characters are formed within a 5 x 7 dot matrix. This means, of course, that lower case letters do not have real descenders as they do on full screen video displays.

The screen is actually a "window" onto a much larger virtual screen. The size of the virtual screen can be defined by the user to be between 20 and 255 characters wide and 4 to 255 lines high. This does not mean that you can define a screen measuring 255 x 255, because that would require far more memory than is available in the HX-20.

The window may be moved horizontally and vertically with the arrow keys or, within programs, by using four Basic language commands: width, scroll, locate and locates. The locate command

"And what have you been doing since you graduated in June 1979?"

moves the cursor anyplace on the screen and automatically displays that portion of the screen in the display window. Locates allows you to display any desired portion of the virtual screen in the LCD display window.

Although the text is formed of pixels, Epson has chosen to offer two independent display modes, text and dot-addressable graphics. On the HX-20 LCD display, these two display modes may be superimposed on each other; this is not possible on an external monitor or TV set.

As delivered, the HX-20 does not drive a monitor or TV set; an extra module, which was not available at the time of this evaluation, is necessary. The specifications I was given for the display dimensions on a monitor or TV set sound a bit strange—32 characters by 6 lines. The graphics display was quoted as 128 x 96 pixels in monochrome or 128 x 64 in four colors.

Our friends at *Personal Computer World* in England tell us that if you use color, a bizarre addressing mode, in which there are 64 physical pixels vertically but 96 addresses, prevails. Hence, either 0,0 or 0,1 will light the pixel at 0,0, but only 0,2 will light 0,2 and so on, alternately. That could lead to some "interesting" effects.

Dual Processors

The HX-20 represents a sharp departure from conventional microcomputer architecture. It uses two 6301 (huh?) microprocessors, designed and manufactured by Epson. They are supposedly compatible with the Motorola 6800. Other computers with multiple MPUs usually use one for processing and memory control and the other for I/O and display functions. In contrast, the MPUs in the HX-20 are in somewhat more of a master/slave relationship.

The master MPU does the processing and also controls the memory, keyboard, display, clock, and barcode reader using external ROM while the slave MPU controls the printer, cassette recorder, RS-232 and high-speed serial ports, and the trickle power function when the unit is turned off. For these functions, the slave uses 4K of ROM which is on the MPU itself. Also on each MPU are 128 bytes of RAM. The two MPUs communicate with each other by means of a 38,400 baud serial link rather than the parallel link that one might expect.

The HX-20 is delivered with 16K of RAM which is optionally expandable to 32K with an external module. We expected that a compact unit like the HX-20 might use 64K memory chips. It does not; the built-in 16K is in the form of eight 16K bit chips. However, the 32K of ROM which contains the monitor, Basic language, and the like is found on four 64K bit chips. There is also a spare socket for 8K of expansion ROM.

The screen is actually a "window" onto a much larger virtual screen.

Built-in Printer

On the top left of the HX-20 a small adding machine-like printer is found. It uses rolls of plain paper 2 ¼" wide. Although standard adding machine paper will fit, we found the Epson paper was better because the ink does not seep into the paper. Thus, it gives a crisper image and much longer ribbon life. Ribbons are available in both black and purple and are unexpectedly easy to replace.

Up to 24 characters can be printed on one line 1.85" in length. The characters appear smaller than those produced on other printers, but are equivalent to 9-point type (the same as the type in this article). In fact, the MX-80 also produces 9-point type. The difference is in horizontal spacing of characters; the MX-80 and other similar printers print 10 characters per inch while the HX-20 packs 13 characters per inch.

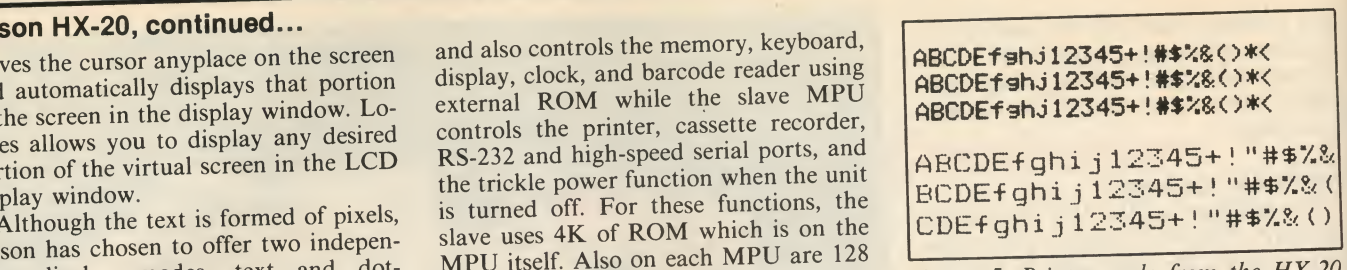


Figure 5. Print sample from the HX-20 computer and MX-80 printer. Note the tighter 13 characters per inch spacing on the HX-20 print compared to the 10 cpi spacing of the MX-80.

For printing of graphics, this closer spacing leads to a crisper image than that produced by many dot matrix printers. Built into the firmware is a simple routine to get a screen print. Also, as mentioned above, LLIST is function key 3.

Printing speed is roughly 17 characters per second or 42 lines per minute. The printer sounds like a swarm of angry hornets being driven from their nest. The MX-80 sounds like a church mouse by comparison.

The HX-20 can drive an external printer, however, at the time of this test we did not have an interface cable or the documentation to build one.

Beeps and Boops

Behind a ½" x 2" rectangle of holes under the LCD display is hidden a speaker. Well, not exactly. It is a piezoelectric device which can be programmed to beep and boop at different pitches and durations.

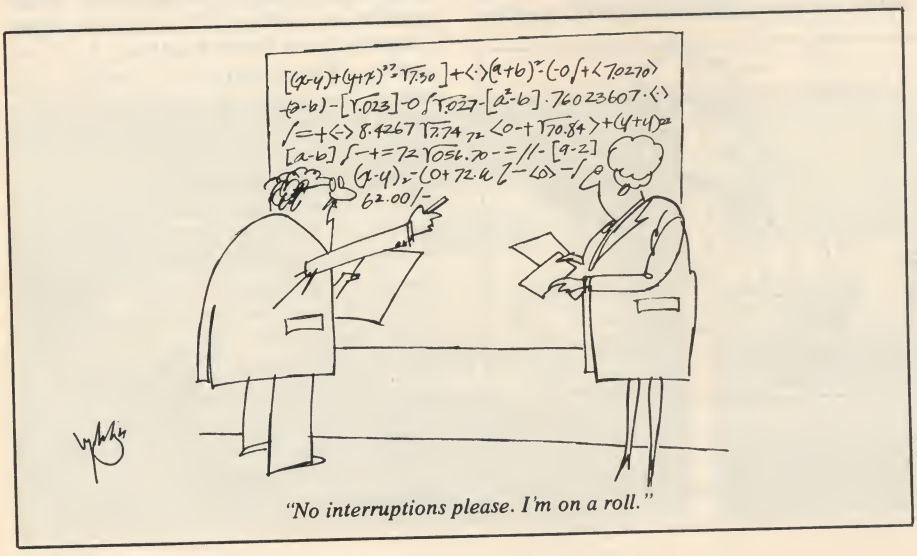
Within Basic is a command, SOUND p,d. The parameter p corresponds to pitch (four-octave range); while the parameter d corresponds to duration in tenths of seconds.

External Devices

Two external devices have already been mentioned, a printer and a monitor or TV. To connect to these and other devices, the HX-20 has two DIN connectors on the back. An 8-pin socket is for RS-232C devices such as terminals, printers, modems, and even other computers. It communicates at speeds up to 4800 baud.

A second 5-pin DIN socket has a maximum transfer rate of 38,400 baud for communicating to disk drives or, with an adapter, to a monitor or TV set.

On the right side are four mini sockets, three of which hook up to an ex-



"No interruptions please. I'm on a roll."

COMPUTERS & ELECTRONICS

WIN AN ATARI® SWEEPSTAKES

Save up to 33% on *Computers & Electronics*, too!

The Computers & Electronics Sweepstakes is open to all our readers. No purchase is necessary–and you'll receive a fantastic Atari home computer system worth over $1600 if you're the lucky winner!

How the Sweepstakes works

Just mail the attached card or the coupon below after filling in your name and address. Be sure to indicate whether you're also subscribing to *Computers & Electronics* at the special rates shown–you can save as much as 33%.

Then, if you win, you'll get a superb Atari personal computer system: the Atari 800 with 16K RAM and 10K ROM…an 810 Disk Drive… 16K RAM Memory Module for

languages, do business accounting, play video games. Programmable in Basic or Assembly, the 800 can use all Atari peripherals and can control up to four disk drives and a 60 lpm printer. In all, the 800 and its accessories form a package worth a full $1620 at retail!

You're sure to win with *Computers & Electronics!*

Whether you win our Sweepstakes or not, the hours you spend on a personal computer–or with home electronics projects–are certain to be winners when you subscribe to *Computers & Electronics* (formerly *Popular Electronics).* It's the Number One magazine in its field–concentrating on computers, but packed with news of

19% OFF=GOOD DEAL ON COMPUTERS & ELECTRONICS

☐ One year (12 issues) of **COMPUTERS & ELECTRONICS** (formerly POPULAR ELECTRONICS) for $12.97–19% off the full subscription price of $15.97.

☐ Two years for $22.97. ☐ Three years for $31.97.

NEW SUBSCRIBERS ONLY

Mr.
Mrs.
Ms. _____
(please print full name) 4X084

Address _____ Apt. _____

City _____ State _____ Zip _____

CHECK ONE: ☐ Payment enclosed ☐ Bill me later.

Add $5 a year in Canada, all other foreign add $8 per year. Please allow 30 to 60 days for delivery of first issue.

☐ One year (12 issues) of **COMPUTERS & ELECTRONICS** (formerly POPULAR ELECTRONICS) for $12.97–19% off the full subscription price of $15.97.

☐ Two years for $22.97. ☐ Three years for $31.97.

NEW SUBSCRIBERS ONLY

Mr.
Mrs.
Ms. _____
(please print full name) 4X084

Address _____ Apt. _____

City _____ State _____ Zip _____

CHECK ONE: ☐ Payment enclosed ☐ Bill me later.

Add $5 a year in Canada, all other foreign add $8 per year. Please allow 30 to 60 days for delivery of first issue.

moves the cursor anyplace on the screen and automatically displays that portion of the screen in the display window. Locates allows you to display any desired portion of the virtual screen in the LCD display window.

Although the text is formed of pixels, Epson has chosen to offer two independent display modes, text and dot-addressable graphics. On the HX-20 LCD display, these two display modes may be superimposed on each other; this is not possible on an external monitor or TV set.

As delivered, the HX-20 does not drive a monitor or TV set; an extra module, which was not available at the time of this evaluation, is necessary. The specifications I was given for the display dimensions on a monitor or TV set sound a bit strange—32 characters by 6 lines. The graphics display was quoted as 128 x 96 pixels in monochrome or 128 x 64 in four colors.

Our friends at *Personal Computer World* in England tell us that if you use color, a bizarre addressing mode, in which there are 64 physical pixels vertically but 96 addresses, prevails. Hence, either 0,0 or 0,1 will light the pixel at 0,0, but only 0,2 will light 0,2 and so on, alternately. That could lead to some "interesting" effects.

Dual Processors

The HX-20 represents a sharp departure from conventional microcomputer architecture. It uses two 6301 (huh?) mi
tu
co
Ot
us
or
dis
in
ma

and also controls the memory, keyboard, display, clock, and barcode reader using external ROM while the slave MPU controls the printer, cassette recorder, RS-232 and high-speed serial ports, and the trickle power function when the unit is turned off. For these functions, the slave uses 4K of ROM which is on the MPU itself. Also on each MPU are 128 bytes of RAM. The two MPUs communicate with each other by means of a 38,400 baud serial link rather than the parallel link that one might expect.

The HX-20 is delivered with 16K of RAM which is optionally expandable to 32K with an external module. We expected that a compact unit like the HX-20 might use 64K memory chips. It does not; the built-in 16K is in the form of eight 16K bit chips. However, the 32K of ROM which contains the monitor, Basic language, and the like is found on four 64K bit chips. There is also a spare socket for 8K of expansion ROM.

The screen is actually a "window" onto a much larger virtual screen.

Built-in Printer

On the top left of the HX-20 a small adding machine-like printer is found. It uses rolls of plain paper 2 ¼" wide. Although standard adding machine paper

```
ABCDEfghj12345+!#$%&()*<
ABCDEfghj12345+!#$%&()*<
ABCDEfghj12345+!#$%&()*<

ABCDEfghij12345+!"#$%&
BCDEfghij12345+!"#$%&(
CDEfghij12345+!"#$%&()
```

Figure 5. Print sample from the HX-20 computer and MX-80 printer. Note the tighter 13 characters per inch spacing on the HX-20 print compared to the 10 cpi spacing of the MX-80.

point type (the same as the type in this article). In fact, the MX-80 also produces 9-point type. The difference is in horizontal spacing of characters; the MX-80 and other similar printers print 10 characters per inch while the HX-20 packs 13 characters per inch.

For printing of graphics, this closer spacing leads to a crisper image than that produced by many dot matrix printers. Built into the firmware is a simple routine to get a screen print. Also, as mentioned above, LLIST is function key 3.

Printing speed is roughly 17 characters per second or 42 lines per minute. The printer sounds like a swarm of angry hornets being driven from their nest. The MX-80 sounds like a church mouse by comparison.

The HX-20 can drive an external printer, however, at the time of this test we did not have an interface cable or the

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 66 BOULDER, COLORADO
POSTAGE WILL BE PAID BY ADDRESSEE
Computers&Electronics
formerly Popular Electronics
P.O. Box 2774
Boulder, Colorado 80321
NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 66 BOULDER, COLORADO
POSTAGE WILL BE PAID BY ADDRESSEE
Computers&Electronics
formerly Popular Electronics
P.O. Box 2774
Boulder, Colorado 80321
NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

COMPUTERS & ELECTRONICS

WIN AN ATARI® SWEEPSTAKES

Save up to 33% on *Computers & Electronics*, too!

The Computers & Electronics Sweepstakes is open to all our readers. No purchase is necessary–and you'll receive a fantastic Atari home computer system worth over $1600 if you're the lucky winner!

How the Sweepstakes works

Just mail the attached card or the coupon below after filling in your name and address. Be sure to indicate whether you're also subscribing to *Computers & Electronics* at the special rates shown–you can save as much as 33%.

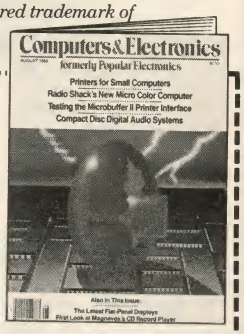
Then, if you win, you'll get a superb Atari personal computer system: the Atari 800 with 16K RAM and 10K ROM...an 810 Disk Drive... a 16K RAM Memory Module for extra memory... a pair of Joystick Controllers for game interaction. Use the Atari to handle small business and professional applications as well as sophisticated home processing functions–and, of course, for entertainment. Analyze your investments, learn languages, do business accounting, play video games. Programmable in Basic or Assembly, the 800 can use all Atari peripherals and can control up to four disk drives and a 60 lpm printer. In all, the 800 and its accessories form a package worth a full $1620 at retail!

You're sure to win with *Computers & Electronics!*

Whether you win our Sweepstakes or not, the hours you spend on a personal computer–or with home electronics projects–are certain to be winners when you subscribe to *Computers & Electronics* (formerly *Popular Electronics).* It's the Number One magazine in its field–concentrating on computers, but packed with news of audio equipment, communications and electronics.

Why not enjoy a year or more of *Computers & Electronics* at our low introductory prices? You'll save up to 33% if you subscribe at the same time you enter our Sweepstakes!

Atari is a registered trademark of Atari, Inc.



OFFICIAL RULES

No Purchase Necessary

1. On an official entry form or a 3" x 5" piece of paper, hand-print your name, address and zip code. Enter as often as you wish, but mail each entry separately to Computers & Electronics Sweepstakes, P.O. Box 2785, Boulder, Colorado 80322. Entries must be received no later than December 31, 1983, and the drawing will be held by January 28, 1984. All entries become the property of Computers & Electronics, which reserves the right to reprint the name and address of the winner.
2. The winner will be selected in a random drawing from among all entries received, under the supervision of the publishers of Computers & Electronics, whose decision will be final. Only one prize will be awarded in this Sweepstakes. Winner will be notified by mail and may be required to execute affidavit of eligibility and release. Odds of winning will depend on the number of entries received. Ziff-Davis will arrange delivery of prize. Taxes are the responsibility of the winner. Any manufacturer's warranties will apply, but Ziff-Davis makes no warranties with regard to any prizes. Prize is not transferable. No substitutions for prizes.
3. Sweepstakes open to all residents of the U.S., its territories and possessions, except employees (and their families) of Ziff-Davis Publishing Company, its affiliates, and its advertising and promotion agencies. Void wherever prohibited or restricted by law.
4. For the winner's name, send a stamped, self-addressed envelope to Computers & Electronics Sweepstakes, Circulation Department, Ziff-Davis Publishing Company, One Park Avenue, New York, N.Y. 10016.

OFFICIAL ENTRY FORM

Mail to: **Computers & Electronics Sweepstakes**
P.O. Box 2785, Boulder, Colorado 80322

☐ **YES!** Enter my name in the Computers & Electronics Sweepstakes, and start my subscription to *Computers & Electronics* for the term checked:

- ☐ One year (12 issues) only $12.97–19% off!
- ☐ Two years only $22.97–28% off!
- ☐ Three years only $31.97–33% off!

Savings based on full one-year subscription price of $15.97.

☐ **NO** I don't wish to subscribe now, but tell me if I've won the Computers & Electronics Sweepstakes.

CHECK ONE:
☐ Payment enclosed.
☐ Bill me later.

4X084

Mr./Mrs./Ms._____
(please print full name)

Address_____ Apt._____

City_____ State_____ Zip_____

Offer valid only in the U.S., its territories and possessions. Please allow 30 to 60 days for delivery of first issue if you subscribe.

ternal cassette recorder. One socket is for input, one for output, and the third for motor control. The fourth mini socket is for a barcode reader.

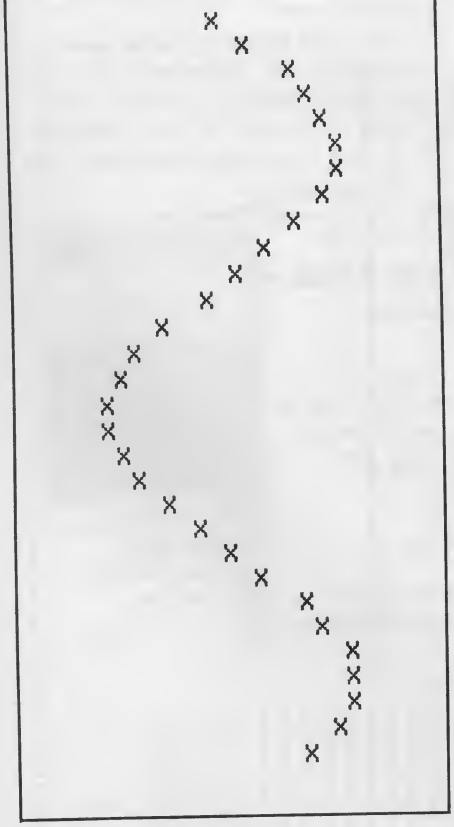
On the left side is a flat connector normally covered by a piece of black plastic. This is a parallel connector for a 16K expansion RAM memory module.

An optional device which, if installed, occupies the top right of the case is a microcassette recorder. This same space can also be occupied by optional ROM software modules. The microcassette recorder is a digital unit, not audio, although it uses standard microcassettes. It reads and writes at a speedy 1300 baud and can store about 50K bytes of data or programs on a 30-minute cassette. This is equivalent to about 40 double-spaced typewritten pages. A nice feature is an accurate tape counter which allows fast winding to a program or area of data before loading. This is not a manual counter as found on other recorders, but is in software. Very neat!

The only other external device is a 6-volt power supply that plugs into the back of the HX-20. This is normally used for recharging and not for computer operation, although it can be if the batteries are low and you simply must use the unit.

Figure 6. Short HX-20 program to print a curve of a sine wave on the built-in printer.

```
5 CLS
200 I=0
210 A=8+8*SIN(I)
220 LPRINTTAB(A);"X"
230 I=I+.3:GOTO210
```



Basic Language

Epson Basic, called EBasic appropriately enough, is similar to Microsoft Basic, but was written by Ski Soft, Inc. of Cambridge, MA.

To enter Basic, you simply select Option 2 from the menu. Almost like a mini-timesharing system, the HX-20 gives you a choice of five program areas. If you do nothing, you will automatically be in P1 (Program Area 1). To get into another area or program, you use the LOGIN command. If you want your program to be added to the menu list, you simply give it a TITLE and it will automatically become the next one on the list.

Once a program has a title and is on the menu list, it cannot be written over. Even giving the command NEW will not erase it. This is a very valuable protection device. Actually, it took me some time to find out how to get rid of a program; a null title seems to be the answer, i.e., TITLE"".

The printer sounds like a swarm of angry hornets being driven from their nest.

Good editing functions such as automatic line numbering starting wherever you wish, line renumbering, delete, and non-destructive cursor movement are provided. Basic also provides a STAT command for getting the statistics on all the programs in the machine (title, size, available memory).

The pause has a second very useful function when writing programs. In particular, it can be pressed while a program is listing. Remember, you see only four or fewer lines on the display. By pressing a number after pause you automatically set a scroll speed from very slow (9) to very zippy (1).

To debug a running program, EBasic incorporates a trace mode. The command TRON turns on the trace mode. What this does is show on the display the line number of each new line as it is executed. Trace can be turned on and off from the keyboard or from statements embedded in the program.

```
100 CLS
110 '
120 DISPLAY$=TIME$
125 LOCATE 6,1,0:PRINTDA
TE$
130 LOCATE 6,2,0:PRINTTI
ME$
140 SOUND5,1
150 IF DISPLAY$=TIME$ TH
EN 150
160 GOTO 120
```

```
11/09/82
17:56:25
```

Figure 7. Program to make the HX-20 into an expensive digital clock. the date and time are displayed in the center of the screen. The program "beeps" as each new second is displayed.

Basic has the usual numeric and string variables. Variable names may be up to 16 characters long and must begin with a letter. Certain words that mean something in Basic are reserved and may not appear in a variable name. For example, NOTE is an illegal name because it begins with the reserved word NOT. There are 137 reserved words.

Commands may be issued in either upper or lower case; the HX-20 is case insensitive in this case (groan). Thus, although output statements (PRINT, LPRINT) will preserve upper and lower case, the Basic language itself doesn't care. To it, the variable names MAX, Max, and max are all the same.

Under the default conditions, the HX-20 allows for up to 200 characters in the string variable workspace. If this is not enough for a given program, the string space can be enlarged by the command CLEAR. For example CLEAR 1000 clears out an area which can store up to 1000 characters. However, a large string space does not mean that you can have one string that is 1000 characters long; the maximum length of one string variable is 255 characters.

EBasic has a rich library of 38 numeric and 13 string functions. The expected math and trig functions are present as well as many graphics and numeric conversion functions. The early copy of the manual with our HX-20 did not have all the functions fully defined or explained; some of them looked most unusual.

Three interesting functions are DAY, DATE$, and TIME$. Since low power is continuously applied to the memory of the HX-20, why not put in a piece of quartz and let the computer tell the day, date, and time (particularly if your parent company is Seiko)? That is what the designers did, hence, once entered, these

TeleVideo

TERMINALS

910	$559.00
912	$689.00
920	$739.00
925	$719.00
950	$929.00
970	CALL

COMPUTERS

800A	$1099.00
802	$2699.00
803	$1949.00
802H	$4695.00
806/20	$4999.00
816/40	$9199.00
1602	$3399.00
1603	CALL

MODEMS

HAYES

Smart	$219.00
Smart 1200 (1200 Baud)	$519.00
Chronograph	$199.00
Micromodem 100	$309.00
Micromodem II	$279.00
Micromodem II (with term)	$299.00
Smart Com II	$99.00
Smart 1200B	$469.00

NOVATION

J-Cat	$119.00
Cat	$144.00
D-Cat	$159.00
103 Smart Cat	$189.00
Apple Cat II	$279.00
103/212 Smart Cat	$439.00
212 Apple Cat II	$609.00
Apple Cat II 212 Upgrade	$309.00

ANCHOR

Mark I (RS-232)	$79.00
Mark II (Atari)	$79.00
Mark III (T..I. 99)	$109.00
Mark IV (CBM-PET)	$125.00
Mark V (Osborne)	$95.00
Mark VI (IBM-PC)	$179.00
Mark VII (Auto Ans/Auto Dial)	$119.00
Mark VIII	$269.00
TRS-80 Color Computer	$99.00
9 Volt Power Supply	$9.00

FRANKLIN

ACE 1000 Color Computer
ACE 1100 Drive & Cover for ACE 1000
ACE 1200 Computer with Disk Drive
ACE PRO PACK:
ACE 1000, Disk Drive,
80 Column Card, ACECalc &
ACEWriter II

MICRO-SCI

Apple & Franklin

A2	$249.00
A40	$349.00
A70	$459.00
C2 Controller	$79.00
C47 Controller	$89.00

RANA

Elite I (Apple/Franklin)	$279.00
Elite II (Apple/Franklin)	CALL
Elite III (Apple/Franklin)	CALL

EAGLE

IIE-1	$1369.00
IIE-2	$1649.00
IIE-3	$2399.00
IIE-4	$3199.00
PC-E	$1579.00
PC-1	$2399.00
PC-2	$2799.00
PC-XL	$3599.00
1620	$3599.00
1630	$5499.00
1640	$6499.00
Cyma Software	CALL

commodore

CBM 8032

$599

CBM64 .... $229
VIC 20 ..... $99
CALL ON
Executive 64 Portable

1520 Color Printer/Plotter	$169.00
1525,80 Column Printer	$219.00
1526	$319.00
1530 Datasette	$69.00
1541 Single Disk Drive	$249.00
1600 VIC Modem	$59.00
1650 AD/AA Modem	$89.00
1701 14" Color Monitor	$249.00
Pet 64	$569.00
Pet 4032	$599.00
CBM 8032	$599.00
Super Pet	$999.00
B128-80	$769.00
BX256-80	$969.00
2031	$299.00
4040	$699.00
8050	$949.00
8250	$1199.00
9060	$1999.00
9090	$2199.00
4023	$379.00
6400	$1399.00
64K Upgrade	$269.00

SANYO

MBC-555PC	$795.00
MBC 1100	$1599.00
MBC 1150	$2099.00
MBC 1200	$1999.00
MBC 1250	$2399.00
FDD 3200-320 K Drive	$399.00
FDD 6400-64K Drive	$499.00
PR 5500	$699.00

ATARI HOME COMPUTERS

ATARI 400

$29*

*Your FINAL PRICE after REBATE when purchased with package as shown.

ATARI

ATARI 400 & 410 Recorder Package

YOU PAY $179.00
You Get ATARI REBATE $50.00
YOUR TOTAL COST $129.00
Retail Value of ATARI 410 $100.00
Net Cost of ATARI 400 $29.00
CALL FOR PRICING ON
THE ENTIRE ATARI XL LINE!

1010 Program Recorder	$74.00
1020 40 Col. Printer/Plotter	$249.00
1025 80 Col. Printer	$449.00
1027 Letter Quality Printer	$299.00
1050 Disk Drive	$379.00
850 Interface	$169.00
1030 Direct Connect Modem	CALL
CX30 Paddles	$12.00
CX40 Joystick	$8.00
CX42 Remote Joystick	CALL
CX77 Touch Tablet	$69.00
CX80 Trak Ball	$49.00
CX85 Keypad	$105.00
CX418 Home Manager	$69.00
CX488 Communicator II	$229.00
KX7098 Atari Accountant	$209.00
KX7101 Entertainer	$69.00
KX7102 Arcade Champ	$75.00

PERCOM

DISK DRIVES FOR ATARI

AT88-S1	$369.00
AT88-A1	$299.00
AT88-S2	$569.00
AT88-S1 PD	$469.00
AT88-S2 PD	$669.00
AT88-DDA	$139.00
AT44-S1	$579.00
AT44-S2	$969.00

TEXAS INSTRUMENTS DRIVE

TX 99-S1	$349.00

RANA

1000 Atari Disk Drive	$319.00

PRINTERS

EPSON

MX80 FT, MX100	CALL
RX80	CALL
FX80, FX100	CALL

OKIDATA

82, 83, 84	CALL
92, 93	CALL

STAR

Stx 80	$169.00
Gemini 10	$299.00
Gemini 15	$479.00
Serial Board	$75.00

SMITH CORONA

TP-1	$469.00
TP-2	CALL
Tractor Feed	$129.00

C.ITOH

Gorilla	$209.00
Prowriter 8510P	$379.00
Prowriter 1550P	$689.00
Starwriter F10-40P	$1149.00
Printmaster F10-55P	$1569.00
Tractor Feed	$109.00

DIABYWRITER

2000 Letter Quality	$1149.00
2500..."NEW"	CALL
Tractor Feed	$109.00

DIABLO

620	$949.00
630	$1769.00

IDS

Call for ALL Configurations on
IDS PRISM PRINTERS.

NEC

8023	$399.00
7710/7730	$2149.00
3510	$1499.00
3530	$1549.00
3550	$1799.00

MONITORS

AMDEK

300G	$149.00
300A	$159.00
310A	$169.00
Color I	$279.00
Color I plus	$299.00
Color II	$399.00
Color III	$349.00
Color IV	$999.00

USI

Pi 1, 9" G	$99.00
Pi 2, 12" G	$119.00
Pi 3, 12" A	$159.00
Pi 4, 9" A	$139.00
1400 Color	$299.00

ZENITH

ZVM 121	$95.00
ZVM 122	$109.00
ZT1 Terminal	$369.00

BMC

12" Green	$85.00
9191 13" Color	$299.00

TAXAN

12 N Green	$129.00
12 A Amber	$139.00

PANASONIC

TR 120 Hi-res. Green	$159.00
CT 160 Dual Mode Color	$299.00

NEC

JB 1260	$119.00
JB 1201	$149.00
JC 1212	$299.00
JC 12-202	$299.00
JC 1203	$469.00

GORILLA

12" Green	$89.00

ALIEN

Atari Voice Box	$119.00
Apple Voice Box	$149.00

TI-40 COMPACT COMPUTER

$209

SHARP PC-1500A POCKET COMPUTER $169.00

PC-1250A	$89.00
125 Printer/Micro Cassette	$129.00
150 Printer/Plotter/Cassette	$172.00

HEWLETT PACKARD

HP 41CV	$209.00
HP 75	$749.00
HP 41C	$146.00

TIMEX sinclair 1000

TIMEX SINCLAIR 1000 $49

16K Memory	$44.95
2040 Printer	$99.95
Mindware Printer	$99.00
Vu-Calc	$17.95
Check Book Manager	$13.95

VISA MasterCard

computer mail order

east 800-233-8950

In PA call (717)327-9575, Dept. 1008A,
Order Status Number: 327-9576
477 E. 3rd St., Williamsport, PA 17701

west 800-648-3311

In NV call (702)588-5654, Dept. 1008A,
Order Status Number: 588-5654
P.O. Box 6689, Stateline, NV 89449

No risk, no deposit on C.O.D. orders. Pre-paid orders receive free shipping within the UPS continental United States with no waiting period for certified checks or money orders. Add 3%(minimum $3.00)shipping and handling on all C.O.D. orders. Larger shipments may require additional charges. NV and PA residents add sales tax. All items subject to availability and price change. **NOTE:** We stock manufacturer's and third party software for most all computers on the market. Call today for our new catalog.

CIRCLE 148 ON READER SERVICE CARD

Figure 8. A simple game, "Hit or Miss," is in the manual. In it you must fire a missile from the bottom of the screen to intersect a car at the top before it hits the running man.

```
100 WIDTH20,64
110 LOCATE4,2,0
120 '
130 PRINT"Hit or Miss"
140 '
150 FOR I=1 TO 3
160 FOR N=1 TO 12
170 SOUND N,1
180 NEXT N
190 NEXT I
196 CLS
200 PRINT"A car will cha
se"
210 PRINT"a man. Press t
he"
220 PRINT"spacebar to fi
re a"
230 PRINT"missile at the
 car.";
240 '
250 FOR D=1 TO 500:NEXT
D
260 '
270 CLS
280 '
290 XM=INT(RND(1)*15+3)
300 PE=INT(RND(1)*5+1)
310 YM=3
320 FOR XC=18TO0 STEP-1
330 LOCATE XC/2,0:PRINTC
HR$(154);
340 LOCATE XC,0:PRINTCHR
$(152);
350 A$=INKEY$
360 LOCATE XM,YM:PRINT"
";
370 IF YM<3 THEN YM=YM-1
380 IF YM<0 THEN 470
390 IF A$<>"" THEN YM=2
400 LOCATE XM,YM
405 PRINTCHR$(151);
410 SOUND XC,PE
420 IF YM<>0 THEN 430
425 IF XC=XM THEN 570
430 NEXT XC
440 '
450 'miss
460 '
470 SOUND 0,20
480 CLS
490 LOCATE 5,2,0:PRINT"Y
ou missed!"
500 FOR I=12 TO 1 STEP-1
510 SOUND I,1
520 NEXT I
530 GOTO 250
540 '
550 'Hit
560 '
570 LOCATE 2,2,0:PRINT"Y
ou hit it!"
580 FOR I=1 TO 3
590 SOUND 2,3
600 NEXT I
610 GOTO 250
```

values are available in programs.

As with the functions, the expected numeric operators are all present. Boolean operators are also available, including the seldom seen implication (IMP) and equivalence (EQV) in addition to the more common AND, OR, NOT, and XOR.

The HX-20 has no calculator mode built in, per se. However, Basic has an immediate mode so that entering a command such as PRINT 3.25/.005+2.4 will cause the calculations to be performed and the answer to be displayed. Furthermore PRINT can by typed as a question mark to minimize keystrokes.

The HX-20 can perform calculations in both single- and double-precision (16 digits) accuracy. Variables and data can be decimal, hex, and octal(!) integers.

All the usual, expected statements and commands are in EBasic along with a few notable additions. In particular, an INPUT$ statement is included; it reads a specific number of characters from the keyboard or a file and waits until they are all delivered before proceeding.

Again, the file handling statements are pretty much as one would expect, but with a few interesting additions. The function LOF returns the length of an open file in bytes. Each file is defined in the form "Device name: file name" with file name being optional. As on DEC's RSTS-11 (Resource Sharing, Time Sharing) system, a file can be easily directed to another device by simply changing the name. Recognized devices include the keyboard, display, internal and external cassette recorders, RS-232 ports, and internal printer. We are told that the ROM software packs will be recognized also.

Files may be saved in either ASCII or a compressed binary format. The files mentioned above (tape, printer, display, etc.) are all sequential files. However, files in the RAM memory are random access. In addition to allocating string space, the CLEAR command can be used to set aside protected file space. Once allocated, individual files can be defined in this cleared area using DEFFIL which defines record length and number of bytes from the beginning of the first record. All types of data may be mixed in a record.

It would seem that RAM memory files would be quite useful for storing tables of constants or conversion factors that must be frequently referenced or for storing data to be passed from one program to another. This sort of capability encourages structured programming since intermediate results are easily set aside for use in the next set of steps.

The graphics commands are adequate if not extensive. PSET lights up one pixel, PRESET turns it off, and LINE draws a line between two defined points. POINT is a cousin of PEEK in that it tells if a particular pixel is lit up.

In summary, EBasic is sophisticated and well suited to the capabilities of the HX-20. We expressed disappointment in the Basic implementation for the DEC Rainbow 100 in that it did not take full advantage of the hardware; this Basic is quite the opposite. As would be expected, the Basic tends to be oriented most strongly toward business, engineering, and educational applications. Graphics games enthusiasts should look elsewhere.

Monitor and Machine Language

When you switch on the HX-20, the screen always shows the menu, the first three lines of which are always the same, namely:

CTRL/@ Initialize
1 MONITOR
2 BASIC

The first line essentially says that pressing the control and ampersand keys together will initialize the computer. This clears all memory contents and the system clock. It also sets default values for memory size, and file space, and reassigns the five function keys to the ten preset functions described above. Thus control/@ is a global and somewhat dangerous command.

Unfortunately the documentation provided no instructions whatsoever for writing machine or assembly language programs. The closest we came to doing anything in assembly language was to use the MEMSET command to allocate space for programs below the space for Basic programs.

If the processor is truly compatible with the 6800, then one could presumably use one of the many books on 6800 programming to write code for the HX-20. I am not sufficiently versed in 6800 programming, or any machine language programming for that matter, to experiment with this.

The monitor commands allow dumping and changing blocks of memory and saving binary files on tape. The monitor also gives you the ability to change the contents of the various processor registers and set breakpoints. One nifty command is K which allows you to set up a "boot" program which is automatically executed when the HX-20 is switched on. Hence, you could have the machine come up in Basic, a word processing program, or anything else you wanted.

With the standard 16K memory, the

amount of memory normally allocated to Basic programs is 12,891 bytes; another 500 bytes are allocated to variable and string file space; the balance is used by the system. Adding the 16K expansion memory pack increases the available program space to 29,275 bytes.

Word Processing

New HX-20 computers are being delivered with the SkiWriter word processing package installed. We are told that a ROM chip can be installed in older machines with the SkiWriter software.

SkiWriter is an adequate, if not extensive, word processing package. Unlike the window in Basic which scrolls in both directions, in SkiWriter, the width of the text display is limited to 20 characters so the window scrolls only vertically.

The package has two basic modes of text entry, overstrike (what you type covers up what was previously typed) and insert (what you type is inserted in existing text without destroying anything). The INSERT key lets you switch between the two modes.

If you do something that SkiWriter doesn't understand, it will beep. You can then press the HELP key, and SkiWriter will tell you what you did wrong. From that standpoint alone, this must be considered one of the friendliest text editors around.

SkiWriter has two block operations, copy and delete. Using the function keys, you simply mark the start and end of a block, which then can be moved (copied) to another location or deleted. SkiWriter will also search for a string of characters, although it does not have an automatic search-and-replace operation—that must be done manually.

```
    The Epson HX-20
SkiWriter word
processing package has
several excellent
features not found on
other notebook
computers.
    These features
include the ability to:
  * operate in either
overstrike or insert
mode.
  * embed printer
formats in the text
(line spacing, and left
and right margins).
  * save files on the
built-in microcassette
recorder.
  * print drafts on
the built-in
microprinter (like this
one).
```

Approximate Pricing

Epson HX-20 plus A.C. recharger	$795
Same with carrying case	820
Microcassette drive	135
16K expansion memory pack	150
Application ROM packs	100
Acoustic coupler	165
Monitor/TV adapter	n/a
Barcode reader	n/a

Documents can be printed on the built-in micro printer (good for lists, notes, and rough drafts of short documents) or on an external serial printer. Only four print format variables can be set: line spacing, right and left margins, and page break. If you have a document that will run longer than one page, you must insert page breaks in the text; without them, you will get a continuous printout. To its credit, SkiWriter allows print format variables to be inserted within the text.

Documents can be saved onto the microcassette recorder. Because of the way it allocates space on the cassette, SkiWriter permits only three documents to be stored on a 30-minute cassette and five on a 60-minute cassette, no matter what the length of each document.

Other Software Packages

Since its introduction, we have seen many packages demonstrated for the HX-20; however, Epson seems to be taking their time getting them to market. Promised are a spreadsheet package, mailing list package, database manager, and a series of educational packages. Some of these will be available on ROMpacks that fit into the machine in the same place the microcassette recorder resides, while others may be available on cassette tape.

Documentation

The documentation supplied with the HX-20 is, in a word, outstanding. Five manuals are furnished with the computer. First is a 74-page Operations Manual that describes unpacking and setting up the computer, as well as care and maintenance. It also discusses the screen editor and gives clear and extensive examples of its use.

Two fat 254-page manuals describe the Basic Language. The first is a tutorial and the second is a reference manual. Written by Ken Skier, they are perhaps the best set of Basic manuals we have ever seen. They are full of examples, screen displays, and tutorial information. Each has an excellent index.

The microcassette drive has its own 80-page manual and SkiWriter comes with a 55-page manual. Both are excellent.

In Summary

The HX-20 is a quantum leap forward in putting the power and capability of a full computer in a compact package. It is aimed squarely at business and educational users, both those willing to do their own programming as well as those seeking a turnkey machine. The planned software releases on ROM pack will enhance the usefulness of the machine substantially.

Personally, I believe the version that will have the widest acceptance is the one with the built-in microcassette recorder. Although using an external tape cassette recorder saves a few dollars on the purchase price, it reduces portability and does not permit the use of the excellent fast wind and seek capabilities. For many purposes, the built-in microcassette will obviate the need for a floppy disk drive (not expected out until well into 1983).

The quality of the full-stroke keyboard is excellent, although because it is actually part of a printed circuit board, there is a noticeable "give" during fast typing. Strengthening or supporting this board would be a welcome modification. Nevertheless, it is certainly suitable for light word processing.

For working on a plane, train, or away from the office the HX-20 is unrivaled. How often I have dreamed of having a spreadsheet or word processing computer with me on cross country or transatlantic plane trips! It would seem that the HX-20 is the answer to these dreams.

The barcode reader is an interesting add-on that could open up a huge market for stock control and sales order applications.

Given the immense marketing clout of the Epson organization, I expect the HX-20 to occupy a significant place in the computer market before too long. This suggests that many third party vendors will rush in to produce software packages which should contribute to the desirability and acceptance of the computer.

Epson America, Inc., 3415 Kashiwa St., Torrance, CA 92505. □

The First Purely Practical Portable

John J. Anderson

After what could politely be called a lengthy hiatus in its tenure at the epicenter of the microcomputer universe, the old champ is back and looking fit as ever. When I first got my paws on it, I felt a twinge of excitement the likes of which I haven't felt since I bought my first machine. It felt good. Like Ali in Manila, Billy Martin, Motown, and the miniskirt, the TRS-80 is back.

The temptation is to say "back in a big way," and that is true, though in this incarnation the TRS-80 in question is the size of a three-ring looseleaf binder. As I reclined on the living room couch listening to records and using the Model 100 to begin this review, it dawned on me that I would never again want to be without such a machine. For the likes of me, the implications for dramatically bolstered productivity are mind-boggling. Word processing in bed, folks—imagine the possibilities.

But is it really a breakthrough? There has been quite a bit of brouhaha of late concerning the TRS-80 Model 100 computer, and you perhaps remain wary. Judging from the hype concerning the product, passed off as journalism by some other periodicals, you are hardly to be blamed. As I had a rather unique perspective on the introduction of the unit, I think it is fair to say that my hearty enthusiasm is tempered by a healthy objectivity. And yet the coming impact of the machine (safely assuming that prices will quickly fall) should not be underestimated.

The story of the Model 100 is not really the story of a TRS-80 at all.

The story of this TRS-80 is not like the story of any TRS-80 that has come before. And just as the introduction of the Model I was a pivotal industry story of the '70s, it is highly likely that the introduction of the Model 100 will be a pivotal industry story for the '80s. But why?

This is a riddle currently being posed by at least half a dozen other manufacturers even as you read this piece. A good answer requires a bit of background, just as it requires a good bit of respect for the designers of the machine.

The Origin Of The Species

First off, we must acknowledge that "TRS-80" is a trademark that Radio Shack liberally sprinkles like fairy dust on every computer it produces. The moniker is no longer used to label the microprocessor residing within a certain machine, but to add reputation, visibil-

The personal, portable daisywheel printer.

Only $599.

For the first time, your letter-quality printer can be used almost anywhere! Bring the new Transtar 120 with you to work, to school, and home again! Conveniently weighing in at less than 19 pounds, it generates unrivaled print quality and is the size of a standard briefcase. The new 120 is so light, so small, that you can take it with you!

Remarkably, the new $599 Transtar 120 is "plug and go" compatible with the best-selling word processing programs. Just plug the 120 into your personal computer and watch this precision printer purr along at 14 cps Shannon text speed producing superscript, subscript, underlining and a true boldface. Even using letterhead is now a breeze with the 120's automatic single sheet loading!

Don't worry about durability: it's a tough little machine. It joins the highly reliable family of Transtar printers with a failure rate that's the envy of the industry: less than 1%. Should your 120 ever need repair, a nationwide network of authorized service centers stands ready for speedy repair on your six-month end-user warranty.

Just think of it: everything you want in a letter-quality printer...anywhere you want it. Only $599.

Transtar

P.O. Box C-96975, Bellevue, Washington 98009

CIRCLE 136 ON READER SERVICE CARD

ity, and a brand-name to otherwise unknown and untried products. I imagine we will have to wait at least another decade or so before Tandy works up the courage to give one of its computers another name.

So the story of the Model 100 is not really the story of a TRS-80 at all. That, too, is a revelation largely neglected by other publications: that this TRS-80 is an import. Another magazine (which shall remain nameless) went so far as to ask Tandy about the philosophy underlying the choice of the 80C85 CPU for the unit. A PR spokesman rushed to answer with sophistic relish, as if Radio Shack had been actively involved in the choice.

The fact is that the 80C85 was chosen by Kyoto Ceramics (Kyocera), the Japanese designers and builders of the original machine. They sold it to NEC for distribution in Japan, and to Tandy for distribution in this country and worldwide (though NEC is in no way enjoined from introducing its own machine). The philosophy emanating from Fort Worth was not very much more than "let's go with that one."

Not to imply the pejorative in any way. On the contrary, the Model 100 is to my mind the best move we have seen from Radio Shack in at least three years. It is one bound to make its stockholders, who have recently been a bit edgy, as well as Model 100 owners, very happy. The TRS-80 name has leapt right back into the middle of the action.

But the record should for the sake of accuracy be set straight on the point of origin of the Model 100.

About a month ago I was visited by a very nice fellow by the name of Tom Priestly from NEC Electronics USA. He showed me a very interesting new portable computer from Japan: the NEC PC-8201. I was very impressed with it. It looked like a portable that really had the potential to go places.

"Finally," I said to him, "a lap machine with a full-stroke keyboard, substantial memory, and a generous LCD (liquid-crystal diode) screen display." And with built-in Basic, word processing, and database software, it wouldn't have to fight the uphill software battle that has often mired Japanese hardware in the American market. My fervent advice to Tom: load them up for shipment to the states as soon as possible.

He said that while no firm plans had been made to bring the machine to this country, NEC was testing the waters, sending up a trial balloon, running it up the flagpole to see if anyone salutes, so to speak. I saluted. With glazed eyes, I murmured that they would be utterly nuts not to start piling units into the next available boat, if not sooner. He only smiled. Little did I know.

Imagine my surprise, when two days later, the chief (DHA, the boss man, the big cheese) stopped in to tell me Radio Shack had announced its Model 100. I then realized just how far the NEC 8201 had already managed to go. It had made the metamorphosis into the Radio Shack TRS-80 Model 100 in the blink of an eye.

But let's give some credit to Tandy, for surely the whole plot was hatched a while back. There are some substantial differences, you see, between the machine that Tom showed me and the Model 100 that appeared at the lab. And while the 100 has features missing from the Japanese "notebook" machine, not all changes resolve in favor of the Radio Shack machine (see the sidebar).

One of the manufacturers that must be slapping its forehead hard right about now is Epson, the Japanese maker of one of the most popular microcomputer printers in the world, the MX-80. Many

"POWER FAILURE"

Goodbye valuable data. Unless you have a Guardian Angel uninterruptable power source on duty.

Guardian Angel switches to 150 watts of backup power in 1/100 of a second or less while alerting you of blackout or brownout conditions. Its rugged 12V battery gives you up to six minutes (15 at half-rated power), enough to save your data and shut down your system if line power does not return.

Guardian Angel is compatible with virtually every major microcomputer system, including Apple, IBM, H-P, TRS-80, Xerox, Eagle and Osborne. Its transient voltage suppressor also prevents system damage from power spikes.

Guardian Angel simply plugs in between your power source and your microcomputer. Its compact size permits either desktop use or out of the way placement.

Protect your investment: see your R.H. Electronics dealer today about Guardian Angel or contact us at 566 Irelan Street, Buellton, CA 93427, (805) 688-2047.

Guardian Angel, with LED power status indicator, automatically safeguards data from blackouts, brownouts for just $595.*

RHELECTRONICS, INC.

*Patents pending, UL listed, FCC approved, 240V/50 Hz version available. Dealers and OEM inquiries invited.

CIRCLE 126 ON READER SERVICE CARD

nizable as dot matrix.

Rather than print quality, the really impressive things about the Siemens unit are its speed and its noise rate. At a staggering 270 cps, with a very quick linefeed, the unit registered 55 decibels. This represents a noise level of less than half that of nearly all the other printers we have examined. The sound is more like that of the windshield wipers in a Volkswagen than the sound of a microcomputer printer.

The ink jet head itself is very easy to remove, though as one might expect, the ink can be somewhat messy. However the manufacturer states that the life of an ink cartridge is typically greater than or equal to 5,000,000 characters. That would mean the printhead would need replacement quite infrequently.

As for the reliability of the unit, frankly we would feel a bit queasy laying out so much money for a technology so new. We had some problems getting the machine up and running—problems ranging from an ill-fitting power cord to faulty interfacing information from customer support. Though these problems were solved very quickly, the indication is that the bugs aren't totally out yet. We guess that at press time only about ten people in this country, perhaps fewer, were truly qualified to service the Siemens unit. That is not enough of a support organization to satisfy us.

Ink jet technology is nonetheless here to stay, and the Siemens PT80/2712 printer will probably be with us for quite a while as well. It certainly runs like a charm now. It merits a two star rating. □

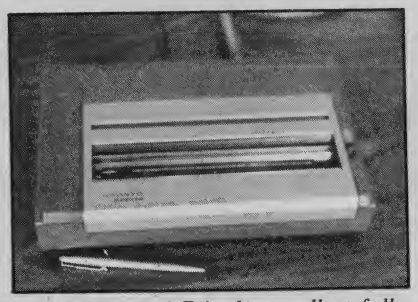
A Truly Pretty Printer

In July of 1982, Sanyo introduced a portable computer called the PHC-8000. It is a multi-featured handheld machine, aimed squarely at the data communications market. On a recent visit to Sanyo, I got a chance to look at it, along with some other goodies the company is readying for release.

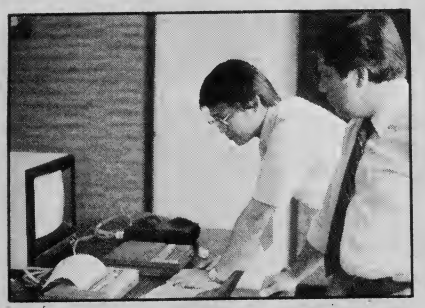
Among these was an utter jewel—a truly exciting new product. It was a printer prototype called the PHC-8000P, although I was warned that the model number might change soon. Granted it is remarkable enough that the PHC-8000P is an impact printer that will list for under $500. The really interesting thing about it is its diminutive size: a mere 12 x 7 1/2 x 2 1/4" (see photo).

Although designed to complement the PHC-8000 handheld unit, the PHC-8000P will sport a Centronics-compatible parallel connector, for easy interfacing to other microcomputers. I saw a working prototype smoothly handle 8 1/2 x 11" single sheet bond paper, and produce letter quality print at a rate of 20 cps, which is a bit faster than many full-size fully-formed character printers. The unique, barrel-shaped plastic print head produced unerring character registration, though the printer proved a bit noisy during use. This is an understandable trade-off considering its extremely small size.

With its incredible portability and very reasonable price, the Sanyo PHC-8000P may become one of the year's big contenders. It could usher in yet another revolution to an already fast-changing market.



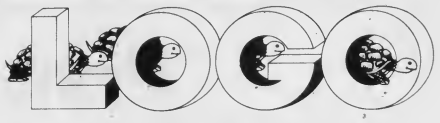
The PHC 8000-P is the smallest fully-formed character printer ever offered.



Yukio Sakaguchi, Project Engineer, and one of the designers of the unit. To his right is Arthur Shebar, Sanyo's national Sales Manager.

The PHC 8000 is the handheld personal computer that mates with the PHC 8000-P, although interfacing other machines will be possible.

LEARN TO SPEAK



Logo is the computer language that's sweeping the country with its simple "turtle geometry" way of learning computer literacy. And *Logo: An Introduction* is the new beginner's guide that makes learning Logo fun!

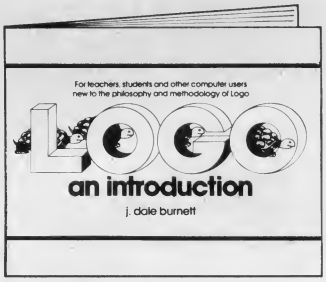
Easy to read and written in simple terms, this outstanding new book from the publishers of *Creative Computing* is designed for teachers and students who have little or no knowledge of Logo or computers.

Logo: An Introduction helps novices with creating geometric shapes, learning about computer memory, playing with curves, learning arithmetic and logic, experimenting with words and sentences, and combining simple commands into more powerful programs.

Logo: An Introduction is written in an open-ended, non-technical style that won't scare your students or bog you down with details. It makes the perfect supplementary text, and a wonderful sourcebook of ideas and suggestions for using Logo in the classroom.

Large 11" x 8½" format • Written by a professional educator • Full of illustrations, examples, tips and suggestions. $7.95.

NEW FROM
CREATIVE COMPUTING!



For faster service
PHONE TOLL FREE: 800-631-8112.
(In NJ only: 201-540-0445.)
Also available at your local bookstore or computer store.

CREATIVE COMPUTING PRESS
Dept. HC9C, 39 East Hanover Avenue
Morris Plains, NJ 07950

Please send me _____ copies of *Logo: An Introduction* at $7.95, plus $1.50* shipping and handling, each. #12L

☐ **PAYMENT ENCLOSED $**_____ (CA, NJ and NY State residents add applicable sales tax.)

☐ **CHARGE MY:** ☐ American Express ☐ MasterCard ☐ Visa
(Charge orders $10 minimum)

Card No._____ Exp. Date_____

Signature_____

Mr./Mrs./Ms._____
(please print full name)

School/Institution_____

Address_____

City_____

State/Zip_____

☐ Check here to receive FREE catalog.

*Outside USA add $3.00 shipping and handling.

Printer Comparison Chart

Manufacturer Name Address Telephone Number	Printer	Price	Type Density	Interface and Connector	Feed
Adler-Royal Business Machines, Inc. (201) 964-3200	SE-5011	$1175	Daisy Wheel	Centronics Parallel, Serial, IEEE 488 optional	Tractor and Friction
Alphacom Campbell, CA (408) 559-8000	Alphacom 42	$119.95	Dot Matrix Thermal 8 x 8	Parallel or Serial	Friction
Anadex, Inc. Chatsworth, CA (213) 998-8010	DP-9000	$1550	Dot Matrix 9x9	Serial and Parallel	Tractor
Anadex, Inc.	DP-9620A Silentscribe	$1845	Dot Matrix 13 x 9	Multiple Serial and Parallel (Centronics and DB25)	Tractor
Apple Computer, Inc. Cupertino, CA (408) 996-1010	Apple Dot Matrix Printer	$675	Dot Matrix 7x9	Centronics Parallel	Friction
Axiom Corp. San Fernando, CA (213) 365-9521	Seikosha GP-50X	$499	Dot Matrix	Multiple Serial and Parallel (Centronics and 5 Pin DIN)	Pin
Bytewriter Ithaca, NY (607) 272-1132	Praxis 30 (Home Version)	$495	Daisy Wheel	Centronics Parallel	Friction
Canon USA, Inc. Lake Success, NY (516) 488-6700	A-1200	$595	Dot Matrix 9x7	Centronics Parallel	Friction and Tractor
Canon USA, Inc.	A-1210 Color Printer	$795	Ink Jet	Centronics Parallel	Friction
Centronics Data Computer Hudson, NH (603) 883-0111	150	$795	Dot Matrix 7x9	Centronics RS-232C	Tractor

Claimed Speed	Graphics	Maximum Width	Character Sets	Descenders	Buffer	Logic Seeking	Pitch
17.5	No	165 columns at 15 cpi 17"	Replaceable Wheels	Yes	No	No Unidirectional	10, 12, 15 cpi
80 cps	Yes	40 columns at 10 cpi 4.5"	1	Yes	1 line	Bidirectional	10 cpi
200 cps	Yes	80 columns at 10 cpi	1	No	2.7K	Yes Bidirectional	10, 12, 13.3 cpi
120-200 cps	Yes	132 columns at 10 cpi 15"	5	Yes	2K	Yes Bidirectional	10 to 16.4 cpi
120 cps	Yes	136 columns 8"	7 plus Languages	n/a	1K	Yes Bidirectional	n/a
50 cps	Yes	80 columns at 10 cpi 9½"	1	Yes	480 Bytes	Yes Bidirectional	10 cpi
12 cps	No	165 columns at 15 cpi	Replaceable Wheels	Yes	No	No	10,12,15 cpi
120 cps	Yes	136 columns 8 1/2"	1	n/a	1K	Bidirectional	n/a
40 cps	Yes 4 colors	80 columns 8 1/2"	1	Yes	n/a	Bidirectional	n/a
150 cps	No	132 columns at 16.4 cpi 8"	1	n/a	n/a	Yes Bidirectional	n/a

Manufacturer Name Address Telephone Number	Printer	Price	Type Density	Interface and Connector	Feed
Computers Intl. Los Angeles, CA (213) 386-3111	Daisywriter 2000	$1495	Daisy Wheel	Serial and Parallel (Custom Cable)	Friction (Tractor Option)
Digital Equipment Corp. Maynard, MA (617) 897-5111	LA50	$850	Dot Matrix 7 × 9	DEC RS-232C	Pin
Epson America Torrance, CA (800) 421-5426	RX-80	$494	Dot Matrix 18 × 18	Parallel (Serial optional)	Tractor
Epson America	FX-80	$699	Dot Matrix 18 × 18	Parallel (Serial optional)	Friction and Tractor
Epson America	MX-100	$749	Dot Matrix 18 × 18	Parallel (Serial optional)	Tractor and Friction
Integral Data Systems Milford, NH (603) 673-9100	IDS 480	$649	Dot Matrix 24 × 9	Serial and Parallel (DB-25)	Pin
Integral Data Systems	IDS Prism 132	$1499	Dot Matrix 24 × 9	Serial and Parallel (DB-25)	Tractor
Leading Edge Canton, MA (800) 343-6833	Gorilla Banana	$249.95	Dot Matrix 5 × 7	Parallel or Serial	Tractor
Leading Edge	C. Itoh Prowriter 8510/A	$495 Parallel, $745 Serial	Dot Matrix 7 × 9	Centronics Parallel or Serial	Tractor and Friction
Leading Edge	C. Itoh Prowriter 2 1550	$995	Dot Matrix 7 × 9	Serial or Parallel	Tractor and Friction
Leading Edge	8600	$1295 Parallel, $1395 Parallel and Serial	Dot Matrix 18 wire Printhead	Parallel or Parallel and Serial	Friction (Tractor optional)

Claimed Speed	Graphics	Maximum Width	Character Sets	Descenders	Buffer	Logic Seeking	Pitch
20 cps	No	132 columns at 12 cpi 15″	Replaceable Wheels	Yes	16K (48K Option)	Yes Bidirectional	10,12 cpi
100 cps	Yes	132 columns at 16.5 cpi	6	Yes	n/a	Bidirectional	5 to 16.5 cpi
100 cps	Yes	136 columns at 17.16 cpi 10″	2	Yes	1 line	Yes Bidirectional	5 to 17.16 cpi
160 cps	Yes	136 columns at 17.16 cpi 10″	2 and 2 downloadable	Yes	2 K	Yes Bidirectional	n/a
80 cps	Yes	233 columns at 17.6 cpi 15″	2	Yes	1 line	Yes Bidirectional	5 to 17.16 cpi
110 cps	Yes	132 columns at 16.8 cpi 9.5″	1	Yes	1.4K	Yes Bidirectional	10 to 16.8 cpi
200 cps	Yes	132 columns at 10 cpi 15″	1 (7 optional)	Yes	3.4K	Yes Bidirectional	10 to 16.8 cpi
50 cps	Yes	80 columns at 10 cpi 10″	4	No	80 Bytes	No Unidirectional	5, 10 cpi
120 cps	Yes	130 columns at 17 cpi 10″	6	Yes	1K Parallel, 3K Serial	Yes Bidirectional	5 to 17 cpi
120 cps	Yes	132 columns at 17 cpi 10″	6	Yes	1K Parallel, 3K Serial	Yes Bidirectional	5 to 17 cpi
180 cps	Yes	132 columns at 17 cpi 10″	15	Yes	2K	Yes	15 to 17 cpi

Manufacturer Name Address Telephone Number	Printer	Price	Type Density	Interface and Connector	Feed
Leading Edge	C. Itoh Starwriter F-10	$1495	Daisy Wheel	Serial or Parallel	Friction (Tractor optional)
Leading Edge	Printmaster F10-55	$1895	Daisy Wheel	Serial or Parallel	Friction (Tractor optional)
Mannesmann Tally Kent, WA (206) 251-5524	MT 160 i	$698	Dot Matrix 7 × 9	RS-232C or IEEE Parallel	Tractor
Micro Peripherals Inc. Salt Lake City, UT (800) 821-8848	Printmate 99	$595	Dot Matrix	Serial and Parallel (Centronics or DB-25)	Pin
Micro Peripherals, Inc.	Printmate 150	$995	Dot Matrix	Serial, (Parallel option)	Pin
NEC Home Electronics Elk Grove Village, IL (312) 228-5900	PC 8023 A-N	$599	Dot Matrix 7 × 9	Centronics, (Serial option)	Friction and Pin
North Atlantic Ind. Hauppauge, NY (516) 582-6060	Qantex 7030	$1995	Dot Matrix 24 × 18	Multiple Serial and Parallel (Centronics at DB-25)	Tractor
Okidata Corp. Mt. Laurel, NJ (609) 235-2600	Microline 80	$449	Dot Matrix 7 × 9	Centronics Parallel	Friction and Pin (Tractor option)
Okidata	Microline 82A	$549	Dot Matrix 9 × 9	Serial and Parallel	Friction and Pin
Okidata	Microline 92	$699	Dot Matrix 9 × 17	Centronics Parallel (Serial option)	Pin and Friction
Okidata	Microline 83A	$899	Dot Matrix 9 × 9	Serial and Parallel	Friction and Tractor
Okidata	Microline 93	$1249	Dot Matrix 9 × 17	Centronics Parallel (Serial option)	Tractor and Friction

Claimed Speed	Graphics	Maximum Width	Character Sets	Descenders	Buffer	Logic Seeking	Pitch
40 cps	Yes	136 columns at 17 cpi 15″	Replaceable Wheels	Yes	80 Bytes, (2K option)	Yes	5 to 17 cpi
55 cps	Yes	136 columns at 17 cpi 15″	Replaceable Wheels	Yes	80 Bytes, (2K option)	Yes	15 to 17 cpi
160 cps	Yes	160 columns at 20 cpi 8.5″	9	Yes	2K	Yes Bidirectional	5 to 20 cpi
100 cps	Yes	132 columns at 17 cpi 9.5″	2	Yes	1K (2K option)	Yes Bidirectional	10 to 17 cpi
150 cps	Yes	231 columns at 17 cpi 15″	5	Yes	2K (68K option)	Yes Bidirectional	10 to 17 cpi
120 cps	Yes	136 columns at 17 cpi 10″	1	Yes	2K	Yes Bidirectional	5 to 17 cpi
180 cps	Yes	132 columns at 10 cpi 15″	4	Yes	4.7K	Yes Bidirectional	10 to 17.1 cpi
80 cps	Yes	132 columns at 16.5 cpi 8.5″	1	No	1 line	Unidirectional	5 to 16.5 cpi
120 cps	Yes	132 columns 16.5 cpi 8.5″	2 (plus foreign)	Yes	1 line	Yes Bidirectional	5 to 16.5 cpi
160 cps	Yes	136 columns at 17 cpi 9½″	2 (plus foreign)	Yes	1 line	Yes Bidirectional	5 to 17 cpi
120 cps	Yes	234 columns at 10 cpi 15″	2 (plus foreign)	Yes	1 line	Yes Bidirectional	5 to 16.5 cpi
160 cps	Yes	233 columns at 17 cpi 15″	2 (plus foreign)	Yes	1 line	Yes Bidirectional	5 to 17 cpi

Manufacturer Name Address Telephone Number	Printer	Price	Type Density	Interface and Connector	Feed
Okidata	Microline 84 Step 2	$1395	Dot Matrix 9 × 17	Centronics Parallel (Serial option)	Tractor and Friction
Okidata	Pacemark 2350	$2695	Dot Matrix 9 × 9	Centronics Parallel	Tractor
Okidata	Pacemark 2410	$2995	Dot Matrix 17 × 17	Centronics Parallel (Serial option)	Friction and Tractor
Siemens Corp. Anaheim, CA (714) 991-9700	Siemens PT-80	$2250	Ink Jet	Multiple Serial and Parallel (Custom Cable)	Friction
Smith-Corona New Canaan, CT (203) 972-1471	Smith Corona TP-1	$695	Daisy Wheel	Specify Serial or Parallel (Centronics)	Friction
Star Micronics, Inc Dedham, MA (617) 329-8560	STX-80	$199	Dot Matrix Thermal 5 × 9	Centronics Parallel	Friction
Star Micronics	DP-8240	$240	Dot Matrix 5 × 7	Parallel and Serial	Friction and Tractor
Star Micronics	Gemini 10X	$399	Dot Matrix 9 × 9	Centronics, RS-232C, 20 mA	Friction and Tractor
Transtar Bellevue, WA (206) 454-9250	Model 315	$599	Dot Matrix 8 × 7	Centronics Parallel (Serial option)	Friction and Pin
Transtar	Model 120	$599 Parallel, $650 Serial	Daisy Wheel	Centronics Parallel or Serial	Friction (Tractor option)
Transtar	Model 130	$895 Parallel, $950 Serial	Daisy Wheel	Centronics Parallel or Serial	Friction (Tractor option)
Transtar	Model 140	$1695	Daisy Wheel	Serial	Friction (Tractor option)

n/a = information not available.

Claimed Speed	Graphics	Maximum Width	Character Sets	Descenders	Buffer	Logic Seeking	Pitch
200 cps	Yes	231 columns at 10 cpi 15″	2 (plus foreign)	Yes	1 line	Yes Bidirectional	5 to 17 cpi
350 cps	Yes	233 columns at 17.1 cpi 16″	2 (plus foreign)	Yes	1 line	Yes Bidirectional	5 to 17.1 cpi
350 cps	Yes	233 columns at 17.1 cpi 15″	2 (plus foreign)	Yes	1 line	Yes Bidirectional	5 to 17.1 cpi
270 cps	Yes	132 columns at 10 cpi 15″	8	Yes	2K	Yes Bidirectional	10 to 16.5 cpi
12 cps	No	126 columns at 10 cpi 15″	Replaceable Wheels	Yes	120 Bytes	Yes	10 or 12 Pitch Models Available
60 cps	Yes	80 columns at 11 cpi 8½″	3	No	1 line	Bidirectional	5.5, 11 cpi
50 cps	Yes	40 columns at 12 cpi	4	No	n/a	No	6, 12 cpi
100 cps	Yes	80 columns	4	Yes	2.3K	Yes Bidirectional	5 to 17 cpi
50 cps	Yes, 4 colors	106 columns at 13.3 cpi 10″	1	Yes	1 line, (2K option)	No Unidirectional	10, 13.3 cpi
14 cps	No	150 columns at 15 cpi 12″	Replaceable Wheels	Yes	1 line (1790 byte option)	Yes Bidirectional	10, 12, 15 cpi
18 cps	No	198 columns at 12 cpi 17″	Replaceable Wheels	Yes	1 line or 2K	Yes Bidirectional	10, 12 cpi
40 cps	No	198 columns at 12 cpi 17″	Replaceable Wheels	Yes	1 line (2K option)	Yes Bidirectional	10, 12 cpi

How to use computers to teach math!

COMPUTERS IN MATHEMATICS:

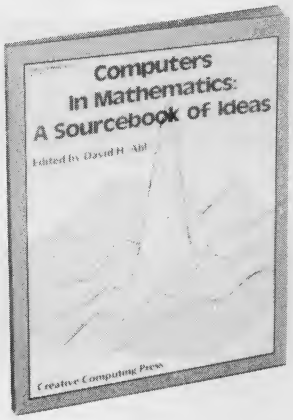
A SOURCE BOOK OF IDEAS

Now that more and more math departments have access to a microcomputer, the problem becomes: How to use the computer effectively as a teaching aid?

Here's where COMPUTERS IN MATHEMATICS can help you. This book of reprints from *Creative Computing* magazine is a goldmine of learning ideas, problem-solving strategies, programming hints, puzzles, brain teasers, and much more!

COMPUTERS IN MATHEMATICS covers nine subject areas:

- Computer literacy and computers in society.
- Thinking strategies and how to solve problems.
- Computer simulations and how to write them.
- Probability.
- Mathematical miscellany, from circular functions to differential equations.
- Art and graphics and their relation to mathematics.
- Computer Assisted Instruction (CAI).
- Programming style.
- Puzzles, problems and programming ideas.



8¼" x 11", softcover, hundreds of black-and-white diagrams and illustrations.

In all, COMPUTERS IN MATHEMATICS contains 77 fascinating articles, over 200 problems for assignment, and nearly 100 programs. Edited and with a preface by David H. Ahl, Editor-in-Chief of *Creative Computing,* this immensely practical volume is an invaluable classroom tool for teachers and students of all grades.

USE THE COUPON TO ORDER YOUR COPY TODAY!

CREATIVE COMPUTING PRESS Dept.HA5B, 39 East Hanover Avenue Morris Plains, New Jersey 07950

Please send me _____. copies of COMPUTERS IN MATHEMATICS: A Sourcebook of Ideas, at $15.95, plus $2.00 postage & handling,* each. #12D

CHECK ONE: ☐ **Payment enclosed $**_____ (CA, NJ and NY STATE residents add applicable sales tax.)

☐ **Charge my:** ☐ American Express ☐ MasterCard ☐ Visa

Card No._____ Expire Date_____

Signature_____

Mr./Mrs./Ms._____
(please print full name)

Address_____ Apt._____

City_____ State_____ Zip_____

*Outside USA add $3.00 per order.

For faster service, call **TOLL FREE 800-631-8112.** (In NJ call 201-540-0445.)

index to advertisers

Reader Service No.	Advertiser	Page
101	Addmaster Corporation	35
105	Advanced Logic Systems	31
158	Allenbach Industries	38
151	Amdek	C3
141	Atari Service Centers	49
103	BASF	17
120	CBS Book Company	137
107	Com-Protect, Inc.	135
143	Computer Distribution Associates	32
108	Computer Exchange	74-75
109	Computerland	2
148	Computer Mail Order East/West	67
149	Computer Outlet	89
128	Computer Palace	13
110	Computer Plus	104
153	Creative Computer Peripherals, Inc.	155
144	Data Assette	11
111	Dataware	35
160	Electronic Specialists	104
	Electrovalue Industrial, Inc.	35
156	Epson America, Inc.	24-25
164	Epson America, Inc.	61
145	Franklin Computer	7
112	General Electric	1
113	Harmony Video & Electronics	43
114	Hayes Microcomputer Products	15
147	Howard Software	53
152	Indus-Tool	104
115	Infocom	36-37
	Interactive Structures	18
116	JRT Systems, Inc.	C4
117	Lyco Computer	41
118	Magic Computer	8
102	Maxell Corp. of America	5
119	Micro Equipment Corp.	146
155	Microsoft	51
142	Micro-Ware Distributing	16
150	National Computer Products	99
121	Nibble Notch	45
146	Nonagon	155
122	Okidata	55
125	Protecto Enterprises	20
154	Qantex	119
126	R.H. Electronics	72
127	R.H. Electronics	73
159	Snave Systems	111
129	Softraders	52
130	Software City	141
131	Spectra Video	C2
132	Strobe, Inc.	26
133	Sweet Gum, Inc.	45
134	Synchronizing Education & Games	146
135	Systems IV Limited	23
136	Transtar	71
137	Transtar	9
138	United Computer Corp.	83

FREE INFORMATION SERVICE

Here's an easy and convenient way for you to get additional information about products advertised in this Buyers Guide. Just follow the directions below and the material will be sent to you free of charge from the manufacturer.

1 Tear out one of the perforated postage-free cards and print or type your name and address where indicated. Use only one card per person.

2 Circle the numbers on the card that correspond to the key numbers at the bottom of the ads for which you want more information. (Key numbers for advertised products also appear in the Advertisers' Index).

3 Simply mail the card—no postage is necessary.

4 To order a subscription to Creative Computing, check the appropriate box on the product information card being mailed to receive additional information. If you prefer you may enter your subscription by using the card in the lower right-hand corner. No postage is necessary.

The addresses on the attached cards are for product information or subscription requests only. Editorial inquiries should be directed to Creative Computing Buyer's Guide to Personal Computers and Peripherals, 39 East Hanover Avenue, , Morris Plains, N.J. 07950

FREE INFORMATION SERVICE

CREATIVE COMPUTING BUYER'S GUIDE TO PERSONAL COMPUTERS AND PERIPHERALS

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123
124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146
147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169
170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192
193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238
239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261
262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284
285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307
308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330
331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353
354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376
377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399
400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422
423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445
446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468
469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491
492	493	494	495	496	497	498	499	500														

4 ☐ Send me one year of *Creative Computing* for $19.97 and bill me. (Full subscription price $24.97.)

PLEASE PRINT CLEARLY—Use only one card per person

NAME _____

COMPANY _____

ADDRESS _____ APT. _____

CITY _____ STATE _____ ZIP _____

(Zip code must be included to insure delivery.) Void after June 28, 1984. CCPC842

CREATIVE COMPUTING BUYER'S GUIDE TO PERSONAL COMPUTERS AND PERIPHERALS

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123
124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146
147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169
170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192
193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238
239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261
262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284
285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307
308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330
331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353
354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376
377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399
400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422
423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445
446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468
469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491
492	493	494	495	496	497	498	499	500														

4 ☐ Send me one year of *Creative Computing* for $19.97 and bill me. (Full subscription price $24.97.)

PLEASE PRINT CLEARLY—Use only one card per person

NAME _____

COMPANY _____

ADDRESS _____ APT. _____

CITY _____ STATE _____ ZIP _____

(Zip code must be included to insure delivery.) Void after June 28, 1984. CCPC841

Save up to 33% on creative computing

☐ Send me one year (12 issues) of *Creative Computing* for $19.97. I save 20%!

☐ I prefer two years for $36.97. I save 26%!

☐ Make that three years for $49.97. I save 33%!

Savings based on full one-year subscription price of $24.97.

MR.
MRS.
MS. _____
(please print full name)

ADDRESS _____ APT. _____

CITY _____ STATE _____ ZIP _____

CHECK ONE: ☐ Payment enclosed. ☐ Bill me later.

Add $5 a year in Canada; all other foreign countries add $10 per year. Please allow 30 to 60 days for delivery of first issue.

4X118

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 27346 PHILADELPHIA, PA.

POSTAGE WILL BE PAID BY ADDRESSEE

creative computing
Buyer's Guide to Personal Computers and Peripherals
P.O. Box 7310
Philadelphia, Pa. 19101

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 27346 PHILADELPHIA, PA.

POSTAGE WILL BE PAID BY ADDRESSEE

creative computing
Buyer's Guide to Personal Computers and Peripherals
P.O. Box 7310
Philadelphia, Pa. 19101

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 66 BOULDER, COLORADO

POSTAGE WILL BE PAID BY ADDRESSEE

creative computing
P.O. Box 5214
Boulder, Colorado 80321

FREE FREE FREE

FREE INFORMATION

about the products and services advertised in this issue of

creative computing

BUYER'S GUIDE TO PERSONAL COMPUTERS AND PERIPHERALS

See other side for directions

AFTER YOUR FIRST DRIVE GO WITH AMDISK.

The AMDISK-I Micro-floppy disk system is an engineering breakthrough in disk size, storage capacity, media protection and user convenience. It's fully compatible with your Apple II*® and Apple IIe and is furnished with an interconnect cable. Enjoy a full 286K storage† capability and the extra convenience of the new 3" hard plastic encased diskette. Packed 10 per box, the disk cartridge fits into a shirt pocket and is easy to mail.

Suggested Retail Price . . . . $299 (3" cartridge $6.99 ea.)

The Amdisk Single Drive system is ruggedly constructed for years of trouble-free operation and is backed with our 90 day warranty on parts and labor.

Just circle the reader service number for complete specifications.

*Apple II is a registered trademark of Apple Computer, Inc.
† Requires recording on both sides

2201 Lively Blvd. • Elk Grove Village, IL 60007
(312) 364-1180 TLX: 25-4786
REGIONAL OFFICES: Calif. (714) 662-3949 • Texas (817) 498-2334

AMDEK CORP.

Amdek . . . your guide to innovative computing!

CIRCLE 151 ON READER SERVICE CARD

What would you give to program

3 to 10 times faster?

Do you find BASIC programming slow, repetitious work?

Put JRT Pascal on your CP/M* system to end repetition, and program 3 to 10 times faster.

Pascal's 'structured' programming divides complex tasks into simple subtasks. Each subtask corresponds to a 'procedure' that—once written—you use again and again just by listing its name. This example procedure is for printing the average of 3 numbers:

```
PROCEDURE PRINT_AVERAGE  (A, B, C : REAL);
   VAR
   SUM : REAL;
BEGIN
SUM : = A + B + C;
WRITE ('AVERAGE IS', SUM/3.0);
END;
```

To call up the procedure from anywhere in the program, just write;

```
PRINT_AVERAGE (3, 6, 15);   or,
PRINT_AVERAGE (−1, 0, 37.4);   etc.
```

Simple, isn't it?—and fast; goodbye repetition.

You can pass/return any type of parameter to a procedure; one procedure can contain others, so even extremely complex programs are easy to manage. Make programs as big as you want, because JRT's 'external' procedures let you use as many diskettes as required. If a change is needed, you change only the module involved, not the entire program. Use common modules for several programs to further reduce time consuming duplication.

The end-result is faster programming—3 to 10 times faster—for just $39.95. But speed and economy are only two of the reasons you'll like JRT Pascal. Why not see for yourself?

Just send the coupon, or give us a call—today.

JRT Features: full support for indexed files; CRT screen formatting and full cursor control; facilities for formatting printed reports; file variables and GET/PUT; dynamic arrays; SEARCH procedures for fast table look-up; extended CASE statements; random files to 8 megabytes with variable length records; 64K dynamic strings; activity analyzer prints program use histogram; 14 digit BCD FLOATING POINT arithmetic; true dynamic storage; advanced assembly interface; fast one-step compiler—no link needed; efficient compiler needs only 85K diskette space; maximum program size is more than 200,000 lines; more than 200 verbal error messages; separate compilation of auto-loading external procedures; no limits on procedure size, nesting or recursion; graphing procedures, statistic procedures.

(Prices subject to change after 1 January 1984.)

Please send me:

☐ **The complete JRT Pascal System Package.** (Specify below.) **$39.95**
The JRT Pascal $39.95 package includes: a 190-page manual in plastic 3-ring binder, two 5¼" diskettes or one 8" SSSD diskette, a Pascal reference card, postage paid (within North America).

☐ **190-page JRT Pascal Manual only.** **19.95**

☐ **JRT Utilities Disk #1** (Specify below.) **29.95**
(Optional: **JRT Utilities Disk #1.** This diskette contains 2 programs. The first neatly formats Pascal source programs for printing, and the second is a disk/map repair utility. Requires JRT Pascal System.)

Specify your system and diskette requirements. TOTAL $
(A 60K CP/M system is required. *CP/M is a Digital Research TM.)

5¼" diskettes for
☐ Apple, CP/M ☐ Kaypro ☐ Superbrain
☐ Heath, Hard Sector ☐ Northstar ☐ Televideo
☐ Heath, Soft Sector ☐ Osborne ☐ Xerox 820
☐ 8" SSSD diskette

☐ Check ☐ Mastercard ☐ VISA
(California residents add 6% Sales Tax. Outside North America, add $15. Checks must be on a U.S. bank, and in U.S. dollars.)

Card # _____ Exp. _____

Signature _____

Name _____

Address _____

City _____ State _____ Zip _____

Send to
JRT Systems, Inc.
45 Camino Alto/O3
Mill Valley, CA 94941

Or phone
415/388-0530
Dealer inquiries invited

CIRCLE 116 ON READER SERVICE CARD